FEBRUARY 1937
VOLUME 14
NUMBER 6

MODERN PLASTICS

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Of General Interest

Technical Section

News and Features

Next Month

Furniture and furnishings of plastics await only the spirit of initiative and courage to bring them into practical being as we shall reveal by presenting three views of an executive's office in our March issue. Even the chair covering fabric enjoys the protection and extra wearing qualities imparted to it by resins. We expect also to be privileged to announce a new industrial molding of startling size and arresting importance. We have been watching its progress and development these many months and have been promised a release date on the story for our next issue—watch for it in March.

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MODERN PLASTICS
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Fig. 1. Laminated plastic pinion used for driving sand mixer

PHENOLIC LAMINATED GEARS

by H. R. MOYER[1]
Westinghouse Electric & Mfg. Co., Micarta Division

Gears of paper and cotton fabric with a resin binder will outwear those of steel, need less lubrication, are more quiet. Their development during the last quarter of a century is outlined here by one of the pioneers

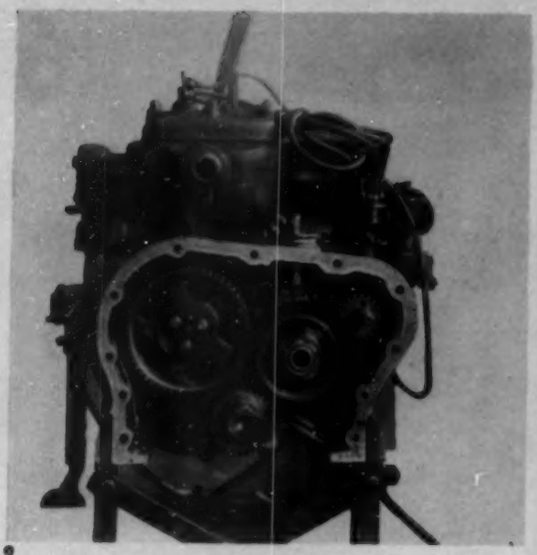
JUST A QUARTER OF A CENTURY AGO LAMINated sheet material with the now common phenolic resin binder was first applied as a gear. Although the laminated phenolic material was originally developed in this country for electrical insulation, the men associated with this development foresaw the possibilities of mechanical applications, first among which was gearing.

This first gear was paper base which, of course, was the material used in the early development of phenolic laminated for electrical insulation. It was soon found, however, that cotton fabric, chiefly because of its higher impact strength, was better adapted as a base material for use in gearing than paper. This early use of fabric base laminated material for gears was the forerunner of subsequent almost limitless use of this type of material to applications of a mechanical nature. It may, therefore, truthfully be said that the great field of mechanical applications of phenolic laminated material had their inception in the first phenolic laminated Micarta gear. Second in importance to this was the development of cloth or fabric as a base for the general class of mechanical applications increasing its strength considerably.

[1] Chairman Non-metallic Gear Committee of the American Gear Manufacturer Association.

Early applications

The first gear was used in a distributor of an automobile engine and the possibilities of this material for timing gears in the automotive industry were immediately sensed. It will be noted that the original phenolic laminated gear dated back to the earlier days of automotive production and even at this early date the demand for more quiet and smooth running automobiles was already being evidenced. One of the sources of noise in the engine was the timing gears. The possibilities of this type of material were immediately recognized. Its resistance



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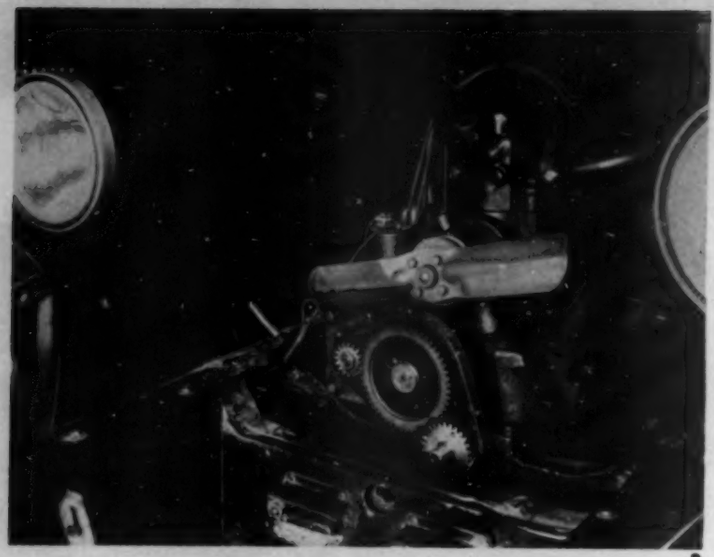

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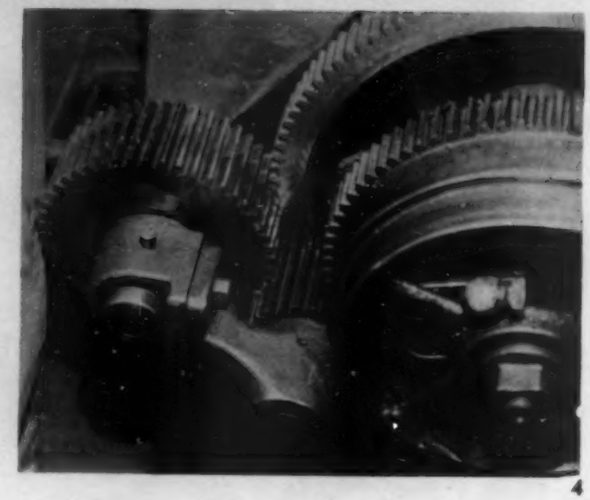
Fig. 2. Four gear front-end drive train with non-metallic idler. Fig. 3. Two gear front-end drive with laminated cam shaft gear. Fig. 4. Pinion and center section of gear at the left have been in operation for 16 years on a key seater



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to the effects of oil, ability to withstand the temperatures of an internal combustion engine, its self-supporting structure and low modulus of elasticity with consequent silent operation put it in an ideal position for use in timing gear trains.

It was, therefore, almost immediately adopted for this service and has been used continuously from that time to the present day. It is true, of course, that in that period of time silent chains have come into use as timing drives but still a majority of cars on the road have phenolic laminated gears in the timing chain and the number of them produced since the first one of a quarter century ago has been millions.

Fig. 2 shows an earlier installation of a molded laminated timing gear in a four gear train. The gear is of the metal center type with molded rim and in this case is an idler gear meshing with the crankshaft generator and cam shaft gears.

Fig. 3 shows a later installation in which only two gears are used, the molded laminated gear being the cam shaft gear. This gear is of the later all-molded type, the center being phenolic fabric base material instead of the conventional metal.

The timing gears are practically all molded to final shape with the bore, and rim finish machined and then teeth cut. The original purpose of using a metal center or web with rim only molded was to reduce cost because of the comparatively high price of the phenolic molded material. This was particularly true in the earlier days. However, with the increased use and production of this material costs were reduced and the complete gear blanks were molded with the exception in most cases of a metal bushing to form the gear seat. Another contributing factor to the change to the all-molded type was the somewhat greater degree of quietness in operation of this type as compared to the metal center or web type.

The application to the industrial field did not lag far behind that of the automotive. Its advantages over the chief competitive material as a quiet operating non-metallic gear was soon recognized in this field as well. The freedom from shrinkage, deterioration by age, attack by vermin or rodents and its self-supporting structure were properties that brought it strongly to the attention of designers, manufacturers and users of industrial gears. Its use in this field started mainly in machine tool drives and spread rapidly to almost all phases of industrial gearing.

It is particularly well adapted to industrial applications where lubrication is difficult or where there is a considerable amount of abrasive dust in the air. Where lubrication is scant or even lacking there is less wear between a phenolic laminated and metal mating gear than between two metal gears. When there is abrasive dust in the air it imbeds in the laminated material and, therefore, has no, or very little, abrasive action on the mating gear to wear it down in continuous operation.

Fig. 1 shows a typical industrial gear. Fig. 4 shows a Micarta pinion on a key-seater which has been in service for sixteen years—over half of the quarter century span of existence of this material.

Fig. 5 is a worm gear application on an oil burner. Where tooth loads are within the elastic deformation limit of the material its use as a worm wheel has been found particularly successful. It has a peculiar property of taking a highly polished surface when properly run in with the mating worm. The metal of the worm should be comparatively hard; ordinary brass is not suitable for this purpose.

Within the period of its existence, therefore, as a gearing material phenolic laminated has had a wide application both in the automotive field as silent timing gears and in the industrial field as spur, helical, bevel and worm gears where its peculiar properties make it adaptable.

Construction details

Almost without exception all laminated gears have machined or cut teeth. However, in the preparation of the blanks two general types, namely, molded to form or shape and sawed blanks from plate or board stock have existed as the two chief forms of blanks almost from the very start.

As previously stated, the original application of the material was as an automotive gear and this was followed almost immediately by its application in the timing drive of the automobile engine. Since even in the early days of automotive production quantities were comparatively large, it was soon found that economical production demanded molding the blanks individually to approximately final form and size. Also with economy primarily in mind the center of the gear blank was made of cast iron costing less than the laminated material and the rim was molded directly on this cast iron center.

As a further saving in the laminated material the rim was formed by building up quarter segments to form the rim. Fig. 7 shows a built segment rim and its final molded form on the knurled cast iron center. From this figure it is also seen that the segments are staggered in adjacent layers to overlap joints as well as to get better thread distribution for more uniform wearing surface on the tooth profile.

This metal center gear was in use for several years when the all-molded type was introduced. The all-molded type in which the center or web was of the same type of molded material as the rim was brought out as a step to greater quietness in operation and it soon replaced the metal center type. With the (*Continued on page 66*)

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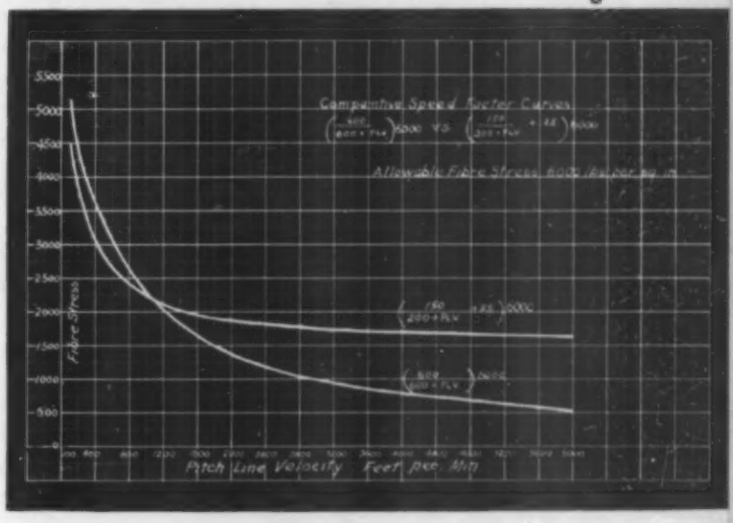

Fig. 5. This phenolic laminated worm wheel increases the efficiency of the oil burner 5%. Fig. 6. Chart showing curve of the two speed factors based on an initial allowable fiber stress of 6000 lbs. per sq. in. Fig. 7. Ring built up of segments for a laminated gear. Fig. 8. Ring built up from notched strip and corresponding laminated gear

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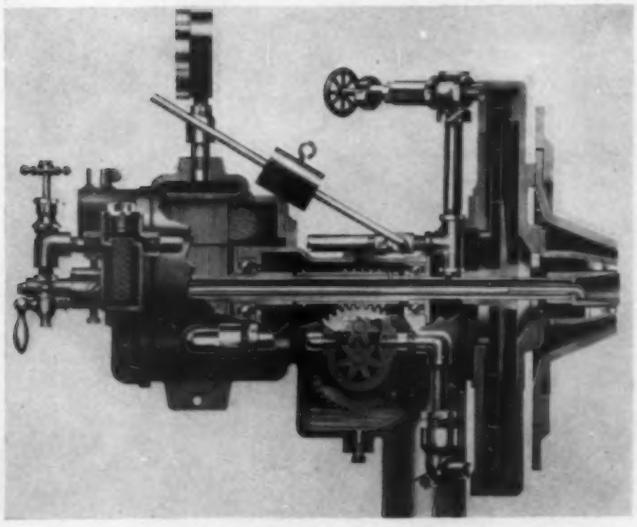

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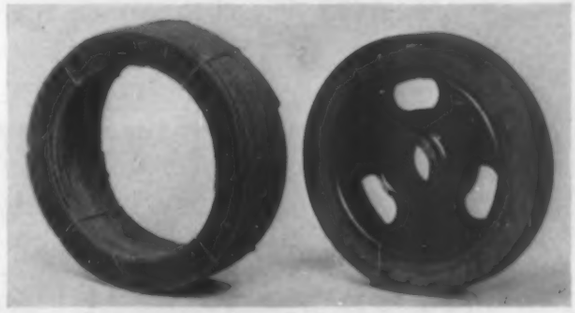

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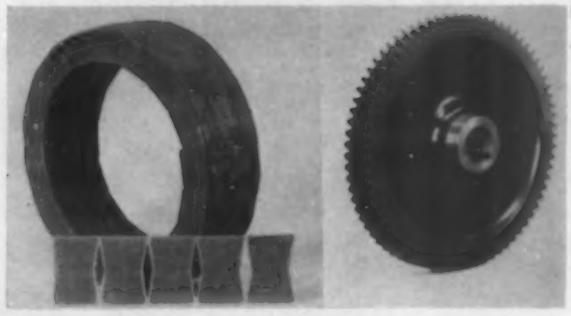

BRANDING YOUR PRODUCT

So many readers asked how they could print on cast and molded plastics and make the printing stay put, that we investigated and found roll leaf stamping one of the satisfactory methods in current use

by JEAN MAYER

ROLL LEAF STAMPING OF PLASTIC MATERIALS is a comparatively new process which cropped up within the last few years and which is destined to increase the use of plastic materials as well as decrease the cost of certain applications in which resins are employed.

The stamping field so far as plastics are concerned first became a source for experimentation when radio manufacturers found that branding their tube bases with a plain burnt process was not suitable since color contrasts were not available. Manufacturers wanted a distinctive mark and for several years chemists labored to produce a product which would adhere or have the proper anchorage. Finally, however, a process was discovered which enabled the stamping to become an integral part of the material itself; it so fused into the material that it could not be rubbed or scratched off. High heat and pressure are necessary to successfully imprint upon plastic articles.

Another field which felt the need for stamping was dresserware. At that time sets were being made of enamel with genuine gold inlaid for decoration. These items were naturally costly until finally pyroxylin toiletware was manufactured and gold leaf stamped on. The decorative effect was practically identical and now dresserware is available at a nominal price. This method of decoration can be applied to either cast or molded jewelry, as well, where metallic or pigment coloring can be impressed without the necessity of employing inlay.

A roll leaf manufacturer was the first to apply the roll leaf process to dome shaped phenolic closures. A trade mark was stamped in the center and floral decoration around the edge of the cap which covered practically the entire area. It was discovered, however, that due to the distortion and ununiformity of the closures themselves, it was impossible to stamp over the entire area. By eliminating the wreath, therefore, reducing the stamping area, commercial results could be obtained. Closures which came from privately owned molds and whose trade name or selling copy was already molded in applied roll leaf stamping to obtain color contrasts, which made the article more easily identified and gave it more individuality and character for promotional selling.

After considerable research and experimentation, the

Closures, shaving brush ferrules, tooth brush handles, radio tube bases and mirror backs, are stamped with roll leaf for identification and decoration. (Courtesy, Griffin, Campbell, Hayes, Walsh, Inc.)

1

1. Various examples of stamping on plastics of many shapes with roll leaf presses. (Courtesy, Peerless Roll Leaf Co., Inc.) 2. Power stamping machine equipped with automatic feed for closure tops. 3. Stamping press equipped with chain feeder for combs

process of roll leaf stamping was greatly improved. Any material, the surface of which can be impressed with heat and pressure, is eligible for this type of printing; wood covered with lacquer, acetate pyroxylin or any of the resinous plastic materials.

There are many and varied types of machines used for stamping plastics. There are presses operated by hand, by foot, automatically, and presses of numerous sizes and shapes; all kinds are available according to the manufacturer's requirements.

Although specifications are varied, the theory of operation is the same. Roll leaf, which is composed of either metallic or pigment colors mounted on paper, which provides a means of carrying colors through the machine, is placed on a bar in front of the head of the press. The leaf winds down underneath the die which is attached to the head and into the roll feed attachment which is gaged to pull as much leaf as is necessary for a particular impression. Thus, new leaf takes the place of the old at each impression. The leaf contains properties which make it possible to transfer with heat. The head of the press is therefore electrically heated and controlled by a switch or thermostatically controlled to insure uniform temperature at all times. Machines are equipped with various mechanical handling and compensating devices which take care of any ununiformity in thickness and shape of the article being stamped. Most platen presses in good mechanical condition can be equipped with a roll leaf attachment, and can produce first class hot stamping or embossing.

Flat stamping may be done with brass or steel type but for decorative designs, signatures and such, hand-cut steel dies are required. Brass is usually sufficiently strong and heat resisting for acetates and other thermoplastics but phenolics and ureas require the strength of hardened steel either in type (*Continued on page 63*)

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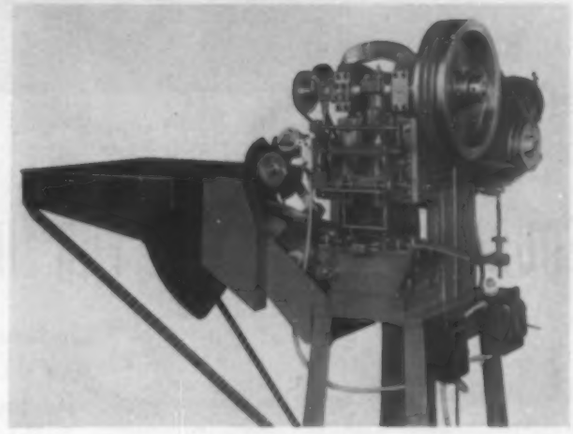

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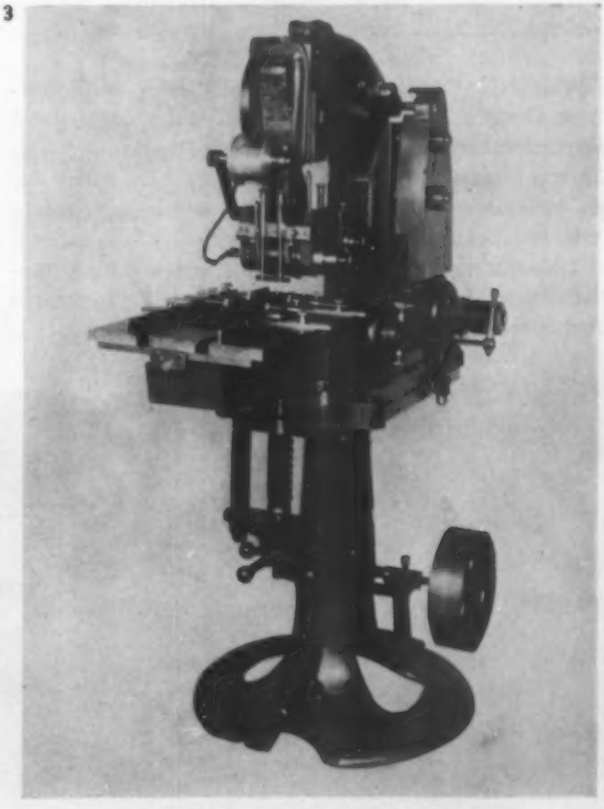
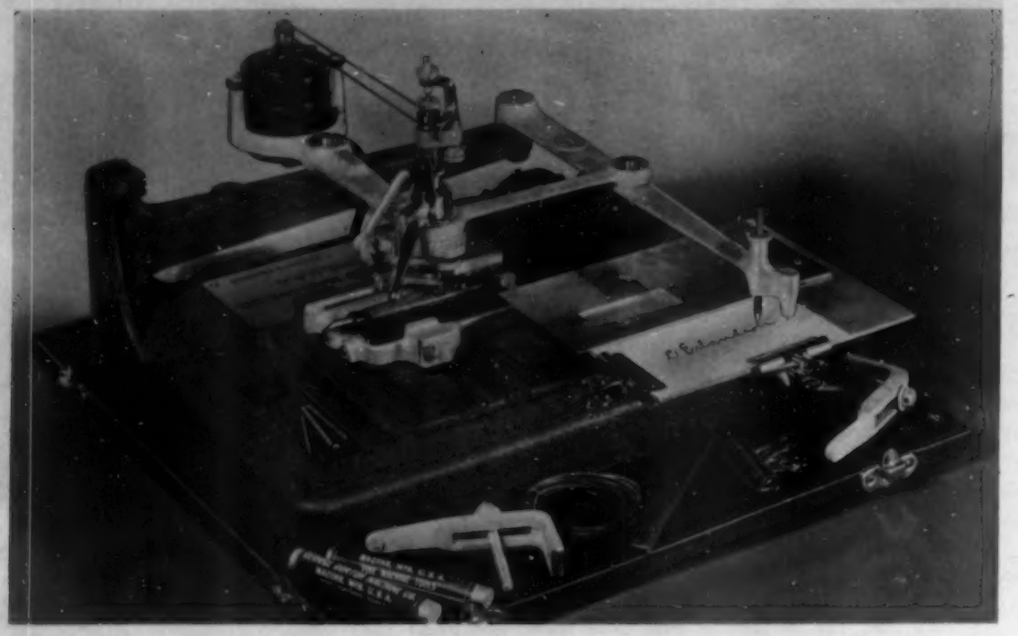




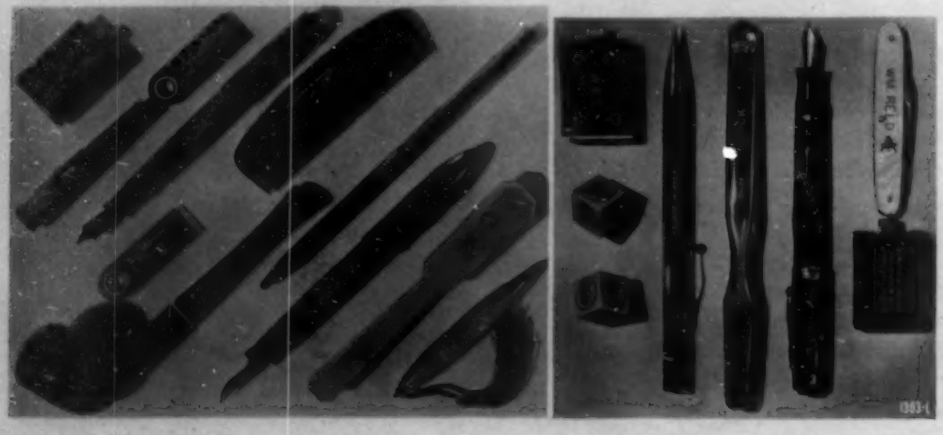
Portable signature engraver with cover removed and pen in place for rapid, permanent marking

ENGRAVING PLASTICS FOR IDENTIFICATION

Individualizing customer purchases is smart merchandising and this engraving device makes it comparatively simple for retailers to engrave plastics. Manufacturers and molders can use it, too, for marking samples and for decoration

STAMPING ON PLASTIC MATERIALS HAS BEcome a source of considerable interest to the industry and we present here still another method of marking.[1] The Gorton Engraver is a light portable machine which engraves lettering and designs on such articles as fountain pens, pencils, cigaret holders and so forth. It is entirely suitable for use in retail stores for personalizing merchandise sold, or it is useful to manufacturers for marking plastic samples in their plants.

The machine employs no heat and does no stamping. The marking is done by cutting the letters or designs with a rotating cutter driven from the small universal motor which is mounted at the rear of the machine. After the lettering or design is cut (approximately .005 in. deep for plastics) it is filled in with gold, silver or white paste, or lacquer to furnish a contrast to the material engraved upon. The pantograph method of reproduction is used as in repro- (*Continued on page 62*)



This variety of objects shows the versatile range of the Gorton Engraver and includes practically every type of plastic material from cellulose to cast resin. Photos, courtesy George Gorton Machine Co.

[1] See article "Branding your product" page 18.

LIGHT IN THE AUTOMAT

by W. WARC JACKSON
Celluloid Corporation

Cellulose acetate extends its benefits beyond portable lamps into extremely satisfactory overhead lighting equipment

THE TREND OF PLASTICS TO PERMEATE INTO every conceivable nook and corner of modern industry is again exemplified by the recent expansion of cellulose acetate from the popular lamp shade field into the more highly specified and scientifically controlled field of modern restaurant illumination.

Modern lighting is looked upon with much respect and its application is given careful consideration in high speed, restaurant design. A far flung cry from the old time "eating-house" are these modern cafeterias in chromium and marble, such as the new Horn and Hardart "Automats," catering to thousands at all hours in the fast-moving metropolitan areas.

These restaurants are impressive in their high degree of light efficiency, free from harsh glare and annoying

Pastel translucent mottled acetate is used for light dispersion in these new fixtures for Horn & Hardart restaurants

shadows. One enjoys an evenness of light which is uniformly dispersed over the floor area showing no partiality in its path and yet presenting a truly unique and decorative effect.

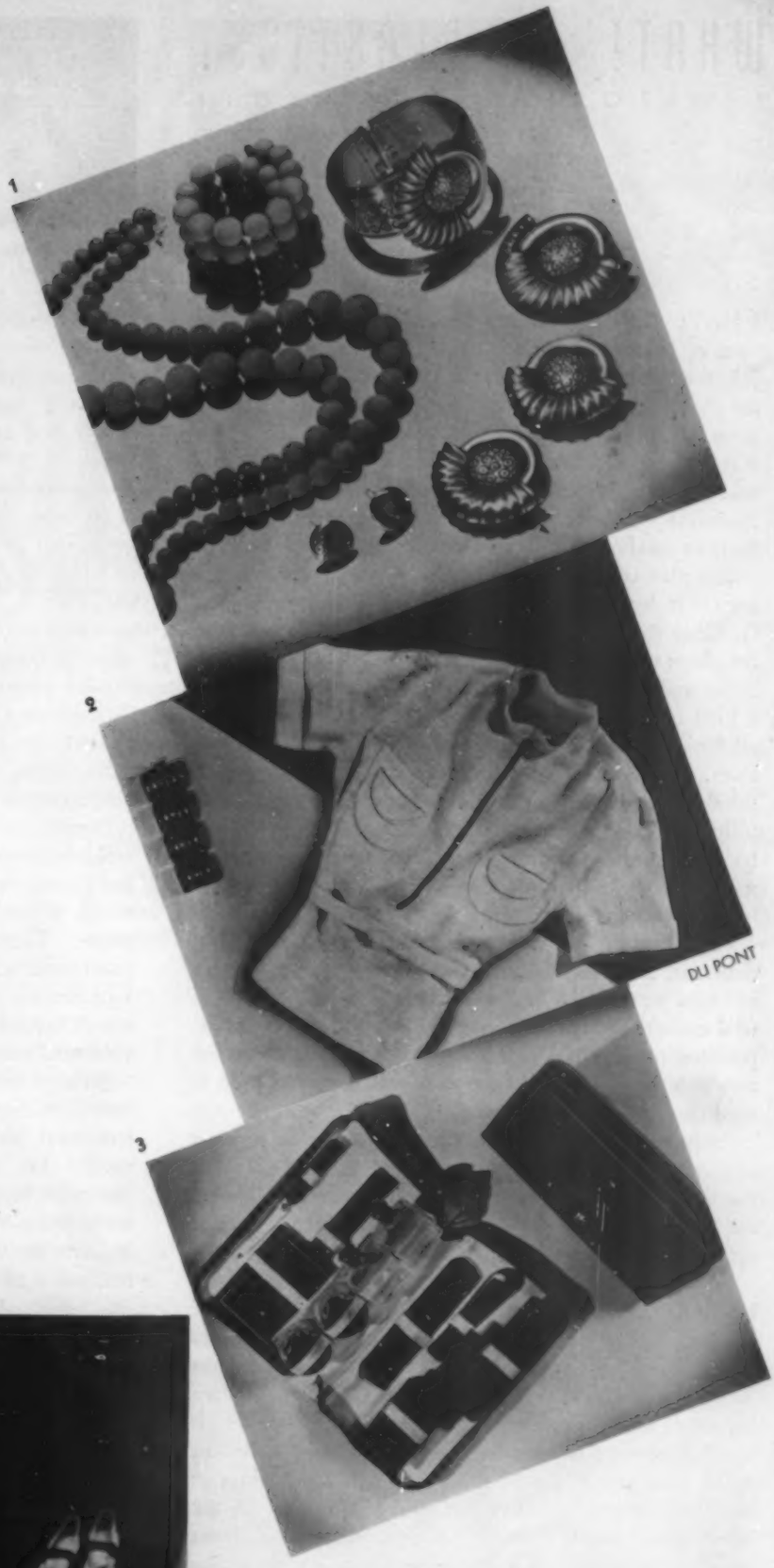
A theory has been expounded that the eating speed of people can be substantially controlled by the degree of light intensity over the subject and focused on the subject's table. A soft mellow light will generally build up a feeling of comfort and will establish a pensive atmosphere, slowing the subject's eating time considerably. It is also expressed that the brighter the light on the table, the faster a person will eat. This, of course, is an important factor in many modern restaurants where the crowds must (*Continued on page 59*)

WINTER ESCAPE

by EVE MAIN

THE TAILORED WOMAN

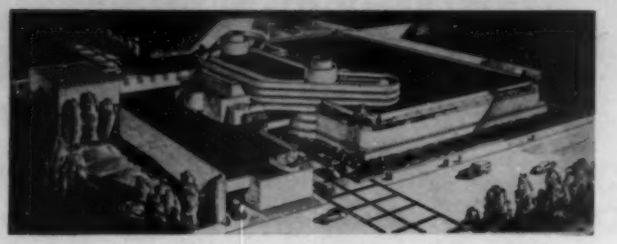
Warm weather outfits and accessories against a background of synthetic palm trees and gay colored travel posters in store windows about town, do their bit toward fostering the nostalgia for a Southward trek by land or sea. Candid camera shots of a few such windows show just what we mean, and indicate, too, that plastics play an important part in furnishing color accents and dash to each travel wardrobe. Generally, plastic buttons, buckles and ornaments in odd shapes and sizes decorate smart frocks, hats and bags for sports, afternoon and evening wear. Specifically: (1) Cast resin necklace and bracelet in a new dull plaster finish in pastel colors to enhance that hoped-for tan. Massive looking gold and silver pieces are not as heavy as they seem for they are made of acetate material covered with metal by a special process. (D. Lisner & Co.) (2) Colorful plastic slide fasteners continue to increase in popularity and it is possible to secure plastic bracelets and other jewelry to match. (3) Neat and compact travel kit with amber color plastic fittings. The case is rich brown moire, quickly and securely closed by a practical slide fastener.



SAKS FIFTH AVENUE

WHAT! NO PLASTICS?

(EDITORIAL COMMENT)



I HAVE JUST READ AN INTERESTING DESCRIPtion of the new $250,000 office building which S. C. Johnson & Son, Inc., makers of Johnson's wax polishes are building in Racine, Wisconsin, to mark the 50th anniversary of the business. Designed by Frank Lloyd Wright, famous for his architectural creations, it is said to constitute an authentic example of Modern American Architecture, and is probably one of the most unusual office buildings ever erected in this country.

The plan centers around one large workroom measuring 210 ft. by 130 ft., to house several hundred employees. Girdling this room is a mezzanine gallery close to the first floor on which are located the offices of department heads and junior executives. Above this hall is a unit, a kind of pent-house on the roof, in the shape of three ellipsoidal links, containing the offices of the chief executives. At a level six feet above the floor a band of tubular glass encircles the building, while a second band follows the rim of the ceiling. There will be no exterior openings in the building except the chambered entrance doors. Air conditioning will be in operation both in summer and winter.

Panel heating through the floor will be an interesting departure from conventional heating systems. A series of brass steam coils laid below the concrete floor slab will convert the floors themselves into radiators. Composition roofing in a pattern that contributes a decorative note to the building is used and cork insulation is used throughout.

Architect Wright, according ro the release, has achieved the last word in the use of the "open plan" with the sense of space we are learning to call modern. There are no corridors in the building—no dead spaces. All space is alive and working.

UNDOUBTEDLY SOME PLASTICS ARE USED IN the structure or in the finish of this monument to progress but none are mentioned. In all sincerity we ask, has Architect Wright taken as great advantage of modern materials as he has taken of modern design? The building industry and those associated with it appear slow to realize and accept the advantages of modern plastics as building materials. They fail to make capital of the three great assets inherent in these materials: light weight; permanent non-corrosive finish which resists not alone wear in use, but the alkalies and cleaning agents with which surfaces are in continuous contact; and resistance to fire. There are notable exceptions, however, in the "Queen Mary" supership of the Cunard Line, and in the addition to the Congressional Library now under construction in Washington, to simply name two.

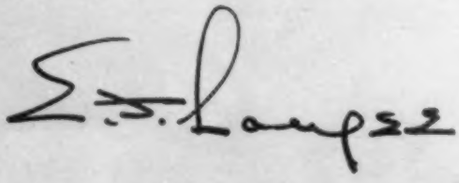
It is interesting to note by way of comparison, that while one industry ignores a material, perhaps because it fails to seek its advantages, another industry saves money and steps up production because of it. Take radio, for example. According to a market survey conducted recently by *Radio Engineering*, 2517 manufacturers of all types make up what is known as the Radio Industry. This group includes 189 suppliers of materials.

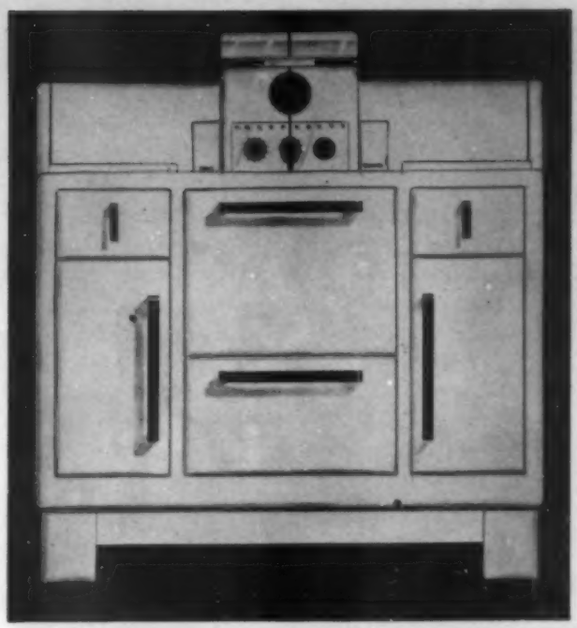
OF THESE RADIO MANUFACTURERS, 2313 (91.9 per cent) buy some form of lacquer, impregnating or insulating material, or binder; 1764 (70.1 per cent) use molded plastics in some form or another; and 2103 (83.6 per cent) use laminated plastic materials. Molded plastics are used in the production of 1060 different radio items, while laminated plastics are used in the production of 1044.

During 1936, slightly more than $3,750,000 worth of molded plastics were purchased by radio manufacturers, and during the same period a little more than $3,650,000 worth of laminated plastics were purchased by the same group. Therefore in this radio industry which approximated a $650,000,000 volume in 1936, $7,410,000 or 1.14 per cent of this total was spent for plastic materials which helped in no uncertain manner to make this huge volume of radio business possible.

Perhaps the building industry will have a ready answer. Perhaps it will say that plastics are not ready for structural purposes. Perhaps it will say they cost too much. Let it be remembered that only a few years ago the radio industry had not learned how to use plastics with profit but it brought its problems to the plastics industry and a solution that justified the effort has been reached as the figures above show.

ALTHOUGH ESTIMATED BELOW NORMAL, THE building industry reached an approximate total in 1936 of $2,675,000,000. Let $30,495,000, or 1.14 per cent of this be offered to the plastics industry and see how quickly new materials will be developed that will prove suitable to every specification. And with this added volume of business, methods and prices more than likely would be brought within bounds.





Sears Roebuck electric stove and hand operated cream separator make intelligent use of plastics for handles. The stove has a plastic gage to indicate oven heat and the handles are combined with chromium for decorative effect

A DESIGNER'S OPINION

An interview with John R. Morgan, merchandise designer for Sears Roebuck Company

by EDNA LONG

JOHN R. MORGAN, MERCHANDISE DESIGNER for Sears Roebuck Company, claims to know very little about plastics yet in the course of his everyday work he has contributed very definitely toward their acceptance and appreciation during 1936. His design of the Silvertone Compact Radio, Election Model, which won first award in the Decorative Group of Modern Plastics Competition, is clear evidence of a practical approach toward the technical economy these materials afford, combined with a technique of molding which gives the cabinet an equally pleasing appearance both fore and aft. This was brought about purely through design and permits the chassis and speaker to be assembled as a unit which can be completed and tested before slipping on the cabinet and screwing it in place.

Mr. Morgan, who was in Europe when the award was made, came with Sears Roebuck during the latter part of 1934 from General Motors.

"The use of plastics," he says, "is particularly adaptable to many articles for retail distribution because of their diversity in color and color combinations. They are extremely suitable to the modern effect of things and because they do not have the limitations possessed by many other materials, they fit well in the scheme of modern design. Plastics adapt *(Continued on page 64)*

Red plastics are used for control knobs and handles on this Sears Roebuck electric ironer because they are decorative and because they quickly identify the controls in operation

Three famous folder dispensers in which laminated plastics are used for both appearance and strength

DISPLAYS MUST BE MODERN

An interview with Robert Kayton whose displays appear in many contemporary merchandising plans

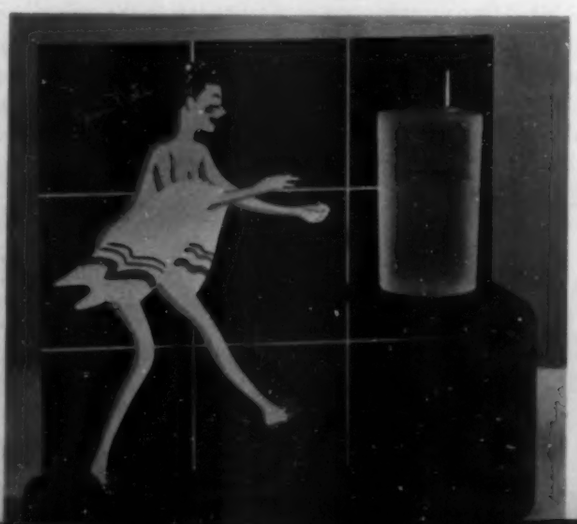
by ROBERT STEPHENS

ROBERT KAYTON WHO HAS BEEN MAKING advertising displays for several years is doing some interesting things with plastics. Displays, he feels, should be based upon the same fundamental principles as any other advertising. To be effective they must include in their construction, sensible copy which is easy to read, appropriate colors and pertinent illustrations. To sell, however, these displays must be built substantially since they are expected to withstand unusual wear and tear.

"We have to consider both these angles in designing and manufacturing our pieces," said Mr. Kayton, "and have finally concluded, after considerable experimenting with various materials, that plastics are quite ideal for long service. Take this plaque, for instance"—and he held up a display sign which had just been completed for John Cavanagh Ltd. "We could not have obtained such character or iridescence by using lacquers or any other material unless a great deal of labor had been involved." The background of the display is white laminated over pressed wood. In the center is a shield inlaid in red and blue laminated. Gold metallic lions appliquéd with a special cement, together with the metallic lettering, form a crest and give the piece a rich appearance. The back has a mahogany hinged easel with a brass hook to facilitate standing and to keep the plaque in place.

Another sign which we were shown was made of wood for Bondworth. A sheet of cellulose was pressed on over the plywood. "Here," said Mr. Kayton, "we obtain practicality by the use of plastics. This particular item is handled a great deal and its light color quickly shows all smudges of dirt and finger marks. Made this way, however, it is so easily cleaned that its length of display is practically indefinite. This

Laminated tiling, a stock product, is used as the background of this display to suggest toiletries



sign has a velour easel attached to the back and a brass hanger ring as well, which make it equally suitable to stand on a counter or to hang on a wall.

We asked if using plastics for displays was more costly to the advertiser.

"No," replied Mr. Kayton, "we have eliminated much of the expense by buying stock items. Take this shield, for instance. It comes from a stock mold and we simply write our copy, have the illustration processed on, fasten a metal easel on the back and the cost of the item is surprisingly low. This particular shield advertises the Australian Mogadore, a silk tie for men. However, with other illustrations and different copy, the same shield can be used for innumerable displays. For example, the Kem Playing Card Company is using this shield, and it is particularly appropriate, since a plastic display well represents a product which consists of pyroxylin cards packaged in a molded box.

"All our displays are not molded, of course, we frequently use stock sheets of laminated material such as this Jean Naté display. The facsimile tile background of plastics is suggestive of bathroom equipment entirely in keeping with the display of a toilet article. Buying sheets which are as decorative as this one and which form such pleasing contrasts is not expensive for the effect obtained, and therefore is ideal for our purpose."

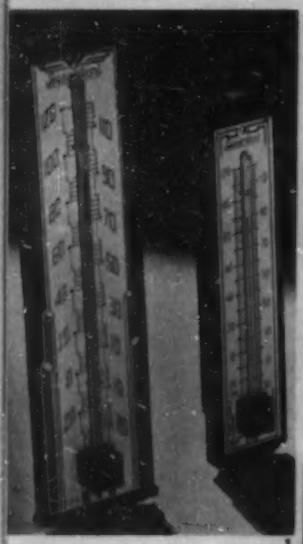
Looking around, we spied three unusual folder containers which were made for well known advertisers: NBC studios, the Empire State building and the French Casino. All three displays are made with a phenolic surface laminated to wood. The one for NBC is mounted on a chromium plated base and Radio City is spelled out vertically giving a skyscraper effect. Inside an opening for the purpose, are pamphlets describing the studios and the public tours.

The Empire State display is similarly done, except that it is in red and black with an illustration of the building processed on the black part. The most unusual piece, however, is the French Casino which is truly "Parisienne" in color and decoration. Following the same construction as the other two, it has a gay and dashing cut-out figure which holds the pamphlets in place. The folders have "French Casino" written across the page and form a background for the lady's hat as well as serving to identify the restaurant.

"We have used plastics for (*Continued on page 56*)

The Bagatelle sign is made with sheet metal letters screwed to a laminated phenolic base. The Cavanagh sign is white Formica with metal letters and shield (Probar Co.) inlaid in the material. The Mogadore and Kem signs employ molded stock shields (Boonton Molding Co.). And the Philips Metalix display at the bottom has a laminated central display piece, and back panels above and below the illuminated X-Ray transparencies

PLASTICS'



1

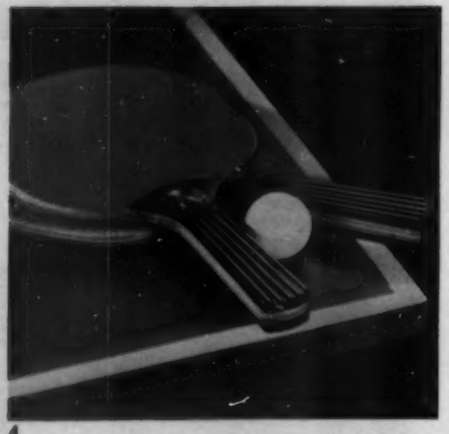
2

1. The Waterbury Button Co. molded this thermometer case with mercury ball protector all in one piece for the Chaney Mfg. Co. The metal face is screwed on and the thermometer is held in place by two brass rings

3

2. A non-automatic six-pound iron, which incorporates a Calrod heating unit, a heat indicator with fabric marked plate, button nooks and heel stand, has a red Textolite handle and thumb rest molded by General Electric Co.

3. West-O-Therm thermometer, made by the Weston Electrical Instrument Co., was designed by Lurelle Guild who employed the contrasting effects of bright chromium and black Bakelite molded



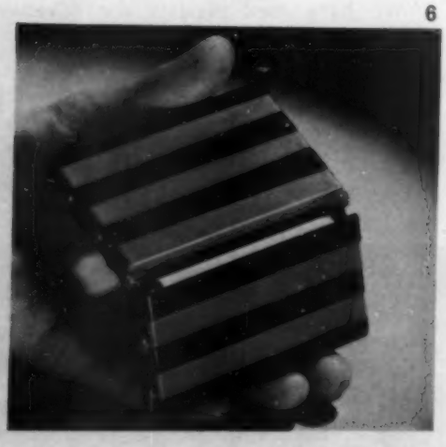
4

4. This "streamlined" table tennis racquet is made for the Orange Mfg. Co. It has a Bakelite handle, molded by Boonton Molding Co., which is grooved to permit a firm and easy grip

5. For anyone using loose printed forms, McCourt Label Cabinet Co. has developed a molded Durez tray which has a spring hinged cover to hold the blanks in place yet which snaps open to permit refilling

5

6

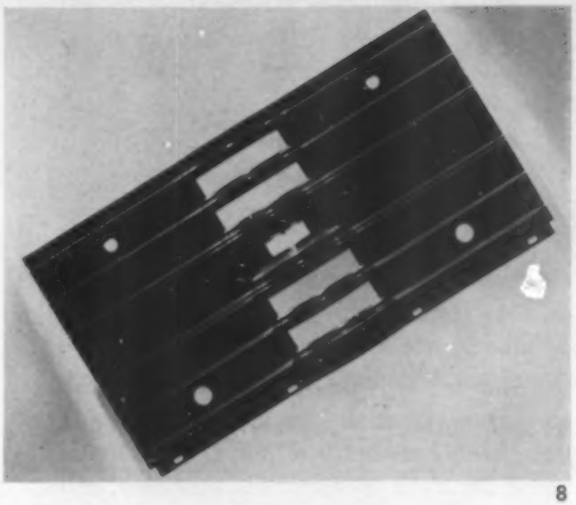


PROGRESS

7

6. This cigaret case consists of eleven molded bars held together with an elastic cord which permits each individual chamber to open backward or forward. Molded of Bakelite and Unyte by the Accurate Molding Co.

7. These Elgin watch boxes molded by Norton Laboratories of Plaskon and Durez were the result of close cooperation between the Warner Case Co. and the Elgin National Watch Co.



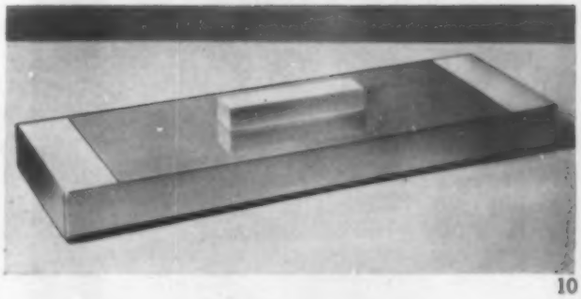
8

8. Central unit of the Graham Paige instrument panel which is molded of Tenite by General Industries. Rich brown in color, it matches the other accessories in the car

9. Two centrifugal type pressure blowers, molded of Durez, are made for Bishop and Babcock. The blowers are designed to deliver plenty of air and permit lower-speed operation and quiet

9

10. A flat cigaret box which holds forty cigarets is manufactured by the Chase Brass & Copper Co. Available in copper or chromium with white Catalin handle and ends



10

11. Geo. F. Berkander makes these novelty shade pulls from sheet cellulose acetate and molding compound. There are many different designs and colors available, and a pull cord is attached to each

11

PLASKON

MOLDED COLOR

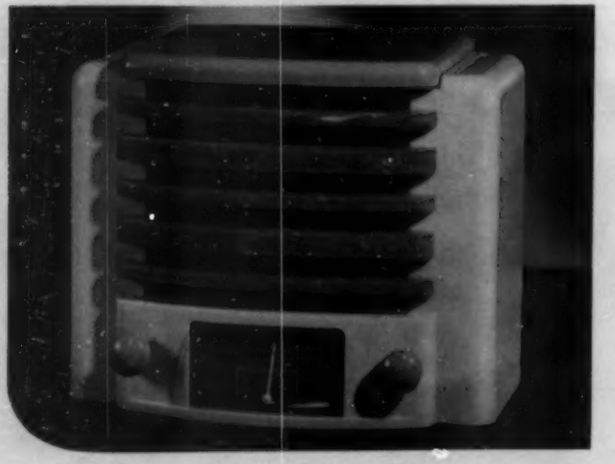
RADIO:

"Taking his cue from the automobile industry, whose phenomenal success has been due to the yearly restyling for sales, the radio manufacturer, too, has realized the necessity of incorporating visual appeal and functional appearance into his product.

"The conviction that plastic materials could have a definitely more sincere expression in radio design than has hitherto been the case, led the International Radio Corporation to pioneer with the idea of using two or three plastic materials in combination . . .

"Our firm was asked to present a design solution working from this idea, which would incorporate sincerity of form, wide color range, lightness, compactness, economy, and speed of production."

The above is from an article by Designers Ferar and Sundberg, that appeared in the January issue of MODERN PLASTICS. And pictured below is the very successful International Kadette . . . in ivory and green Plaskon with a matching grille of green acetate. Molded by Chicago Molded Products.



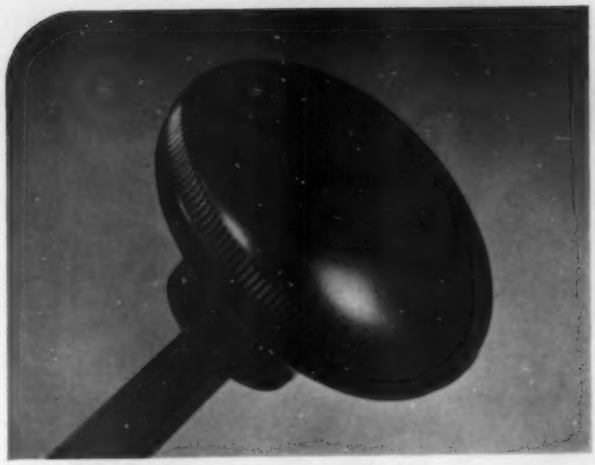
COSMETIC CONTAINERS:

Plaskon is serviceable as well as attractive. In fact, next to its knack of increasing sales for every kind of product, Plaskon's ability to take it is the big reason why packagers specify Molded Color most frequently. It's comforting to know that your package is doing nicely by your customers, and it's the best insurance you can buy for future sales.

Take for example these Elmo rouge and eye-shadow containers in blue and white Plaskon. They will last long after their original purpose has been served because Plaskon is strong as it is colorful. Their tops and bases fit tightly together because Plaskon threads evenly and easily. And because Plaskon is heat-resistant and grease-proof, the Elmo products within will always remain fresh. Can't we investigate your package problem for you? Free of charge of course.

Molded by Closure Division of Armstrong Cork Products Company, Lancaster, Pennsylvania.

FEBRUARY • 1937



GEARSHIFT KNOB:

Glance at the fittings next time you are gliding along in a '37 car, and likely as not you'll find them to be Plaskon. All in all, Molded Color is used on eleven different 1937 automobiles for window fittings, dashboard dials, dome lenses and horn button and lighting switch assemblies.

And inasmuch as manufacturers can standardize on Molded Color for all interior fittings on all Models—due to Plaskon's wide color range—still wider application in 1938 seems inevitable.

But to return to 1937, to swell still further the list of automotive uses comes the Studebaker gear shift knob molded in mouse gray Plaskon. Among the properties Studebaker demanded for this part were molded strength, smooth, pleasant-to-the-touch surface, uniform color, and a guarantee that the color would be the same after years of handling.

Molded by Consolidated Molded Products Co.

WATCH BOX:

This month Plaskon presents its fourth nationally advertised watch container in Plaskon. The watch is the Elgin and the new container is the attractive turquoise package shown above.

Watch manufacturers have come to require Molded Color because jewelers like Plaskon boxes for rings, watches, etc., better than any other used. And little wonder. These plastic boxes are better looking, more modern in appearance* and stronger than any they have ever had. And in light-fast Plaskon jewelers have found what they long have looked for—jewelry boxes that will stand up against sunlight and the powerful lamps used to illuminate jewelry store windows. Molded by Norton Laboratories, of Lockport, N.Y.

*Note the Elgin name molded in the box. The use of plastics enables a box manufacturer to achieve intricacies of design (wipe in, embossing, etc.) possible in mass production of no other material.

PLASKON COMPANY
INCORPORATED

SMART USE OF TRANSPARENCY

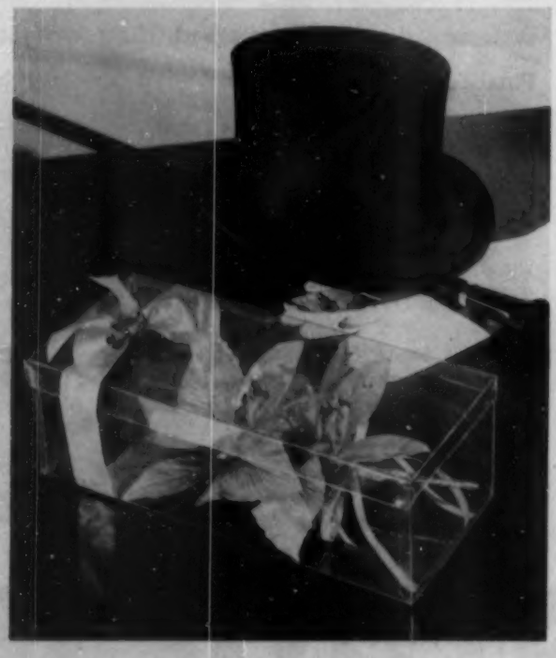
The vogue of transparency in utility boxes and packaging gives transparent cellulose an opportunity to demonstrate its peculiar qualities of toughness and flexibility combined with ease of fabrication and long life

NEW TRANSPARENT BOXES OF LIGHTWEIGHT plastic keep hats, shoes, stockings, and other accessories fresh and clean on closet shelves and eliminate the feverish search because the contents of each box are visible at a glance. Travelers on extended journeys may pack their clothes in these transparent containers which keep ties, shirts, pajamas and such, spotlessly clean and fresh. They are good, too, for shoes because they are kept separate from more fragile articles of apparel yet remain free from scuffing and soiling in travel.

The young man about town may now present his corsage in an attractive transparent box, visibly enhancing the gift, and revealing its freshness and beauty at the first glance.

These boxes are made of sheet cellulose acetate, a tough, rigid plastic material capable of great wear, easy to fabricate, and comparatively inexpensive considering the additional selling impetus given to items so packaged. Many retail stores, recognizing the advantages of transparency, include these boxes in the price of purchase while others make a slight additional charge for the convenience.

Closet boxes in a variety of sizes are sold separately and have met with tremendous demand. Hat boxes of the conventional shape are furnished either with a transparent cover or with one of paper covered board held in place with wide ribbon bands. Some are equipped with a hat cone of the same material.

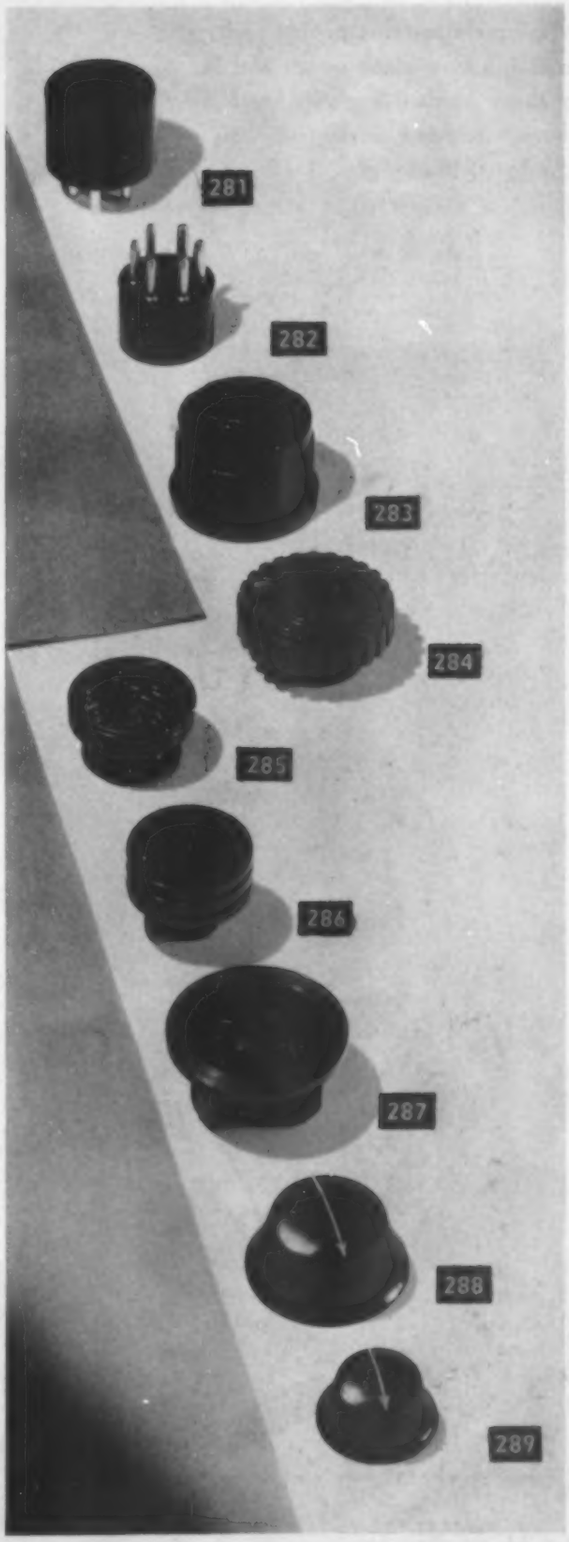


Sheet cellulose is used to protect all sorts of merchandise in the shop, in the home, or on the road. While the protection is complete, the identity of each item is always visible in these containers which deliver safely and give service over a long period of time. Those illustrated are made of Plastacele, a product of the du Pont Company

Stock molds

SHEET TWENTY-SEVEN

Here are molded radio parts which may be obtained by radio manufacturers with greater economy since they do not involve the mold costs, which privately owned molds entail. Write for samples on company letterhead



281. Standard tube base with six metal prongs; diameter 1 3/16 inches

282. Standard tube base with six metal prongs; diameter 1 inch

283. Base with decorated sides; diameter at top 1 in.; diameter at bottom 1 5/16 inches

284. Large knob with widely knurled edge for grip; decorated top approximately 1 3/4 in. in diameter; threaded opening at bottom 1/4 in. in diameter

285. Decorated knob with threaded opening at bottom 1/4 in. in diameter

286. Flat-topped knob with double-grooved sides; threaded brass opening about 3/16 in. in diameter

287. Knob with cross-bar design on top; diameter 1 3/4 in., insert diameter 1/4 in. at opening

288. Control knob with knurled sides, directional arrow, threaded opening; entire diameter 1 1/8 inches

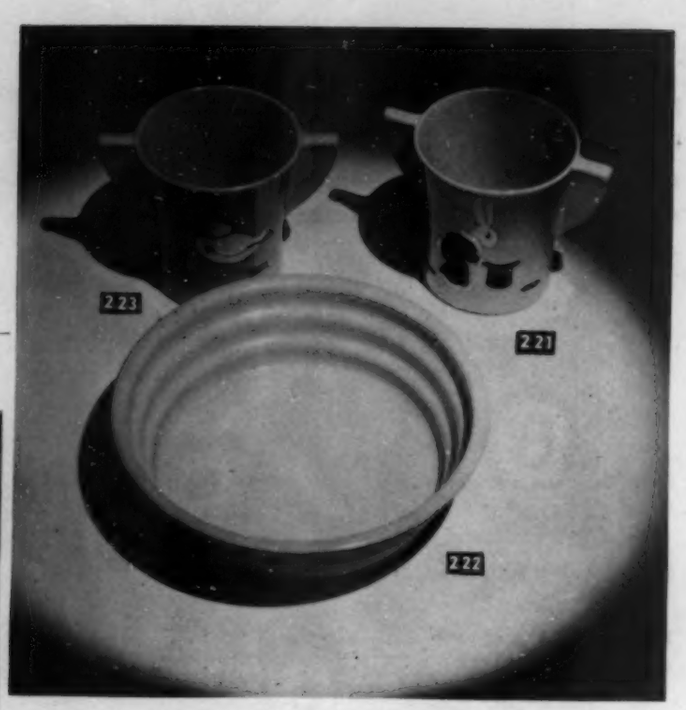
289. Control knob of same design, 7/8 in. in diameter

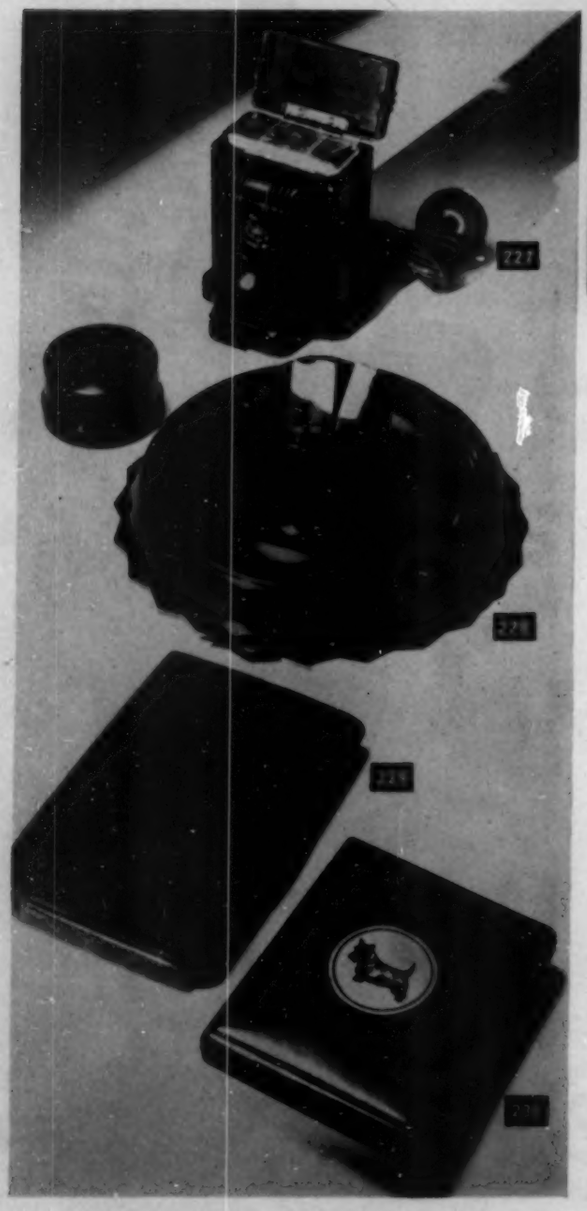
Address all inquiries to Stock Mold Department, Modern Plastics, 425 Fourth Avenue, N. Y. C. All molders are invited to send samples from stock molds to appear on this page as space permits.

Stock molds

SHEET TWENTY-EIGHT

Many premiums that people really want are available from stock molds and the owners of these molds will gladly send samples to those interested executives who write on company letterheads and who specify sheet and item number when writing for samples





221. Mug 2 3/8 in. diameter and 2 7/8 in. high. Has a rabbit painted on

222. Dish 5 in. diameter and 1 1/2 in. high

223. Same as 221 with a painted duck. Available in various colors

227. Electric cigaret or cigar lighter with hinged cover holds one package of cigarets, and can be connected to any convenient electrical outlet. The white button in the front controls lighter

228. Ash tray with center bowl to hold several cigarets. Diameter of container 1 3/4 in. Base has saw tooth edge. The cap at the side is the cover which keeps the cigarets fresh

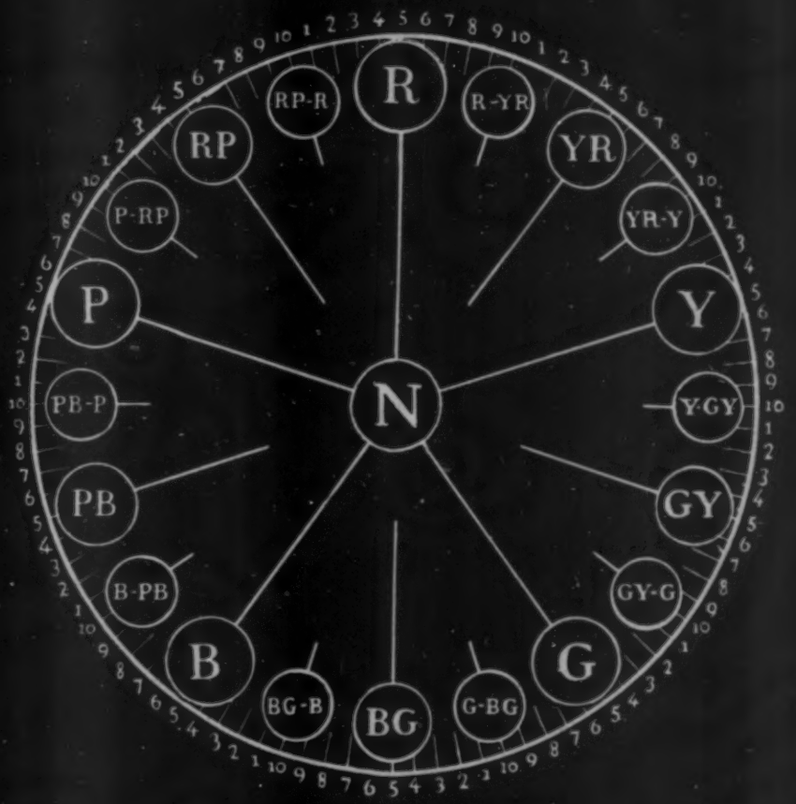
229. Flat cigaret case of mottled plastics 3 7/16 in. long, 2 7/8 in. wide and 13/16 in. high with hinged cover

230. Cigaret case with metal inlay decoration. 3 7/16 in. long, 2 7/8 in. wide and 13/16 in. high. Spring-hinge cover

Address all inquiries to Stock Mold Department, Modern Plastics, 425 Fourth Avenue, N. Y. C. All molders are invited to send samples from stock molds to appear on this page as space permits.

TECHNICAL SECTION

MODERN PLASTICS



THE CIRCUIT OF THE MUNSELL SYSTEM OF COLOR NOTATION—SEE PAGE 49

STREAMLINED OIL BURNER *

Molded Durite Housing by Consolidated Molded Products Corp.

A FEW REASONS WHY DURITE WAS CHOSEN FOR THE BETHLEHEM-DOE OIL BURNER HOUSINGS

1 *For beauty and durability.*

2 *For non-resonance and quiet operation, a salient factor in domestic mechanical appliances.*

3 *For finish, molded Durite having a smooth material-color, black satin finish requiring no initial painting and eliminating re-finishing.*

4 *Durite is light in weight with strength predominating. It is well adapted to streamlining and blends perfectly with the general design of the component metal units.*

5 *Assembly of the housing is simplified by the use of a light weight plastic material. An accurate fit for each unit is accomplished by controlled precision molding, resulting in a uniform, snug fit over the metal flange.*

6 *The principal objective of efficiency has been achieved, and economy in production and operation has been gained by low initial cost. A further economy has been effected by minimizing shipping weight.*

DURITE TRADE MARK REG.

Says Bethlehem Foundry & Machine Co., discussing the development of their Bethlehem-Doe Streamlined Oil Burner: "Then came re-designing for simplification—to eliminate the unnecessary—to blend the necessary into a complete scientific structure of maximum efficiency, safety and dependability, to sell at the lowest possible commensurate price."

Durite Plastics are proud that this manufacturer uses Durite for an important molded pump housing for Bethlehem-Doe Oil Burners. The reasons for this choice may be found in the column on the left.

However, this is but one of many thousands of applications where Durite has been the specified choice of leading companies for many years. If you have never had occasion to learn of their advantages, write and ask about these unusual plastics by Durite, the exclusive producers of phenol-furfural resins.

DURITE *Plastics*

TRADE MARK REG.

Frankford Station P. O., Philadelphia, Pa.

A DIVISION OF STOKES & SMITH COMPANY

A TRANSPARENT PHENOLIC MOLDING COMPOUND

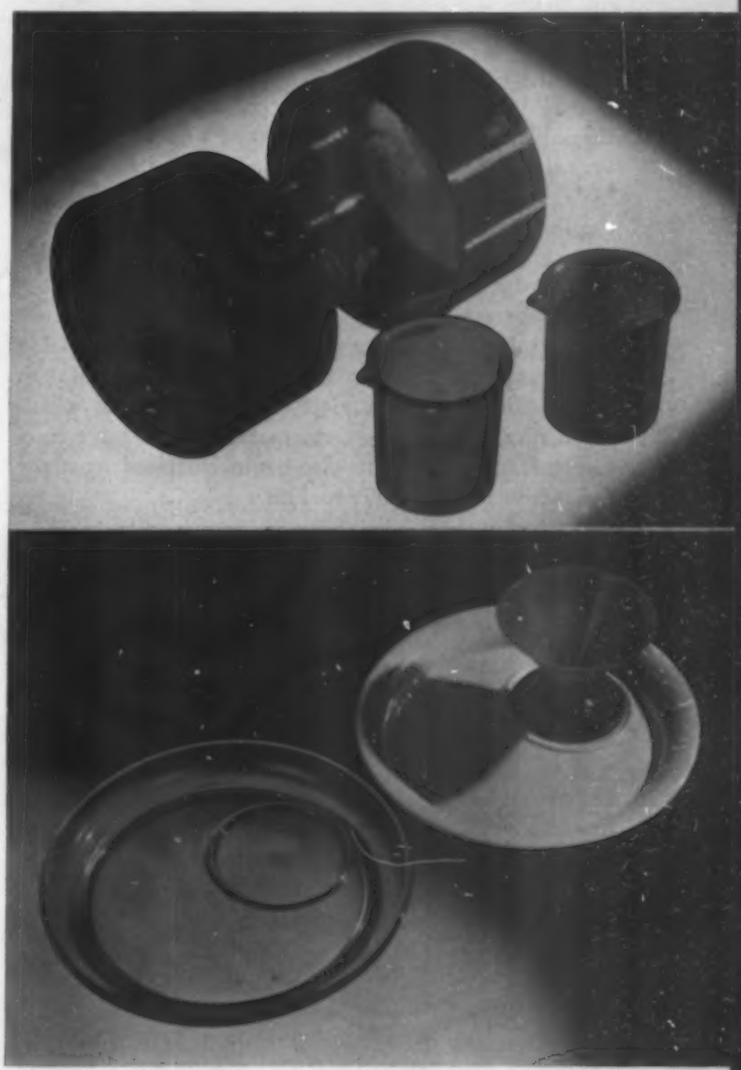
by S. LEON KAYE
Chief Chemist, Universal Plastics Corp.

Chemists here and abroad have long been working on a transparent phenolic molding compound, and while we have not had an opportunity to verify the properties set forth in this brief story, we present the development as one of interesting progress. (Editor)

"THERE IS AS YET NO UNFILLED PHENOLIC molding compound on the market. Here lies another challenge to the chemist, if given the opportunity. What is more some one will do it." This quotation comes from an article in MODERN PLASTICS, the issue of March 1935. Now, in less than two years, the Universal Plastics Corporation enters the plastics field with Uniplast, the answer to that challenge.

Uniplast is a pure phenol-formaldehyde condensation product of a resitol type that needs no fillers. Its transparency suggests its use wherever clear color is desired in a thermosetting molding material. Clear white transparency is not possible, of course, but starting with very light amber this new material may be pigmented or dyed in a complete range of brilliant colors as well as in innumerable tones in the lighter shades of molding compounds. This is well illustrated in the photograph of the two snack trays one of which is ivory in color, the other transparent. The cocktail glass is also molded of Uniplast, with the base of Bakelite.

The use of this fillerless phenol-formaldehyde molding compound, is in no sense confined to decorative fields. It embodies all the electrical qualifications inherent in such resinous materials with none of the detracting qualities which a filler may introduce. In electrical and insulating applications involving widely divergent requirements of dielectric strength, this new material may be varied in formula to cover the entire range of existing demands. No single (*Continued on page 60*)



The transparency of these phenolic moldings is clearly visible in the powder box covers and cream jugs in the top photo. A comparison of the transparent with a light ivory opaque is shown in the illustration above. Buttons and rouge box at the left are in brilliant colors

SYNTHETIC PLASTICS FROM MIXED PHENOLS

by LAWRENCE E. STOUT, SOLDON FELDMAN and JACK ELLIS
Washington University

A series of mixed phenol resins were prepared, ranging in composition from pure phenol with formaldehyde to pure cresols with formaldehyde. The molding characteristics and the optimum time of cure of the phenol and the phenol-cresol mixtures up to 70 per cent cresols were determined. Resins of 80, 90 and 100 per cents cresol were incapable of producing molding powders

COVELL[1] STATES THAT THE PRESENCE OF o-cresol in a tar acid intended for the production of a synthetic resin is extremely objectionable since it produces a very slow reacting resin, when condensed with formaldehyde. Because so few experimental data are available in the literature on the preparation of synthetic resins from tar acid fractions and since no such data are available on the use of mixed phenols for this purpose, it seemed desirable to determine how certain binary mixtures of phenol and cresols differ from pure phenol in their condensation with formaldehyde. It was hoped that a study of such binary mixtures might yield some information which could be applied to the condensation of the more complicated mixture of phenolic bodies obtained from the destructive distillation of coal tar.

Experimental procedure

Resin formation. Equimolecular quantities of formaldehyde and a known mixture of phenol and one of the cresols were placed in a 2 liter round bottom Pyrex flask and mixed. The flask was fitted with a reflux condenser and about 100 cc. of water and 15 cc. of concentrated ammonium hydroxide (sp. g. 0.9) added. The reaction mixture was boiled under 100 per cent reflux until the resin attained the desired viscosity. This was determined by removing a sample and determining its brittleness when cooled. Approximately 30–45 minutes were required for this. The resins and supernatant aqueous layer were then poured from the flask and allowed to cool. The cooled resin was washed well with water, air dried and weighed. It was next dissolved in acetone and the solution mixed with the filler (60 mesh sawdust) in the proportion of three parts resin to two parts filler (by weight). This mixture was air dried, then ground to pass a 60-mesh sieve, 15 per cent by weight of hexamethylenetetramine added and the whole thoroughly mixed.

Molding equipment. A 12-ton laboratory-type Elmes hydraulic press, equipped with two electrically heated platens was employed. Temperatures were measured by a thermometer permanently attached to the upper platen of the press. The mold employed for testing molding characteristics produced small rotors used in distributors of automobile ignition systems and had a diameter equal to that of the press ram. Therefore, the pressure exerted upon the molded object was equal to the pressure on the ram as read from the press pressure gage.

TABLE I—TIME FOR CURE AT 325° F. OF RESINS PREPARED FROM PHENOL-CRESOL MIXTURES

Resin Number	Mol % Phenol	Mol % Cresol	Cresol Used	Time of Cure Minutes
1	100	.....	.....	6
2	92.3	7.7	ortho	10
3	80	20	"	20
4	70	30	"	17
5	60	40	"	20
6	50	50	"	15
7	40	60	"	19
8	30	70	"	20
9	20	80	"	did not cure
10	10	90	"	did not cure
11	.....	100	"	did not cure
12	90	10	meta	20
13	80	20	"	16
14	70	30	"	11
15	60	40	"	10
16	50	50	"	9
17	40	60	"	22
18	30	70	"	18
19	20	80	"	did not cure
20	10	90	"	did not cure
21	.....	100	"	did not cure
22	90	10	para	15
23	80	20	"	12
24	70	30	"	24
25	60	40	"	20
26	50	50	"	19
27	40	60	"	18
28	30	70	"	18
29	20	80	"	did not cure
30	10	90	"	did not cure
31	.....	100	"	did not cure

Chemicals. The chemicals used in this work were of the grades indicated: Phenol—U.S.P.; o-cresol—Eastman Practical; m-cresol—Eastman Practical; p-cresol—Eastman Practical; formaldehyde—U.S.P. 37%; hexamethylenetetramine—U.S.P.

Resins were prepared from the binary mixtures of phenol and cresols specified in Table I. These resins and the molding powders produced from them were all

[1] Covell, Plastics 7, 319 (1931).

prepared and molded in an identical manner. Consequently the sole variable was the composition of the phenolic portion of the starting materials. The effect of this variable was measured by determining the minimum time of cure required. The experimental conditions used were: molding temperature—325° F., molding pressure—2½ tons per square inch. The minimum time of cure was taken as that required to produce a molded object which would show no discoloration after immersion in boiling water for eight minutes. It should be noted that data have been listed only when the product showed from formaldehyde analysis that the reaction had gone to completion.

Results

Table I lists the minimum time of cure for each of the resins prepared and Figure I shows these data plotted against percentage of cresol in the resin. Table II indicates a series of molding observations obtained for each of the binary mixtures specified in Table I. The approximate time range during which molding is satisfactory may also be inferred from these data. Table III shows the effect of temperature upon the time of cure for resins 1, 4, 14, and 24. These represent the resins from formaldehyde and pure phenol and the binary mixtures of 70 per cent phenol with 30 per cent of o-, m-, and p-cresols, respectively. These results are illustrated in Figure II.

Table I shows conclusively that the addition of even small quantities of any one of the three cresols to phenol causes a sharp increase in the minimum time of cure required for the production of a molded product from a synthetic plastic. Moreover, the time of cure increases with increasing percentages of cresol up to a certain point for the three systems investigated. Beyond this point, however, each system possesses its own characteristics, although the phenol:o-cresol and phenol:p-cresol systems resemble each other more closely than they do the phenol:m-cresol system. In each system studied the resins obtained from percentages of cresol higher than 70 were thick viscous products which would not become brittle on cooling. They did not lend themselves to the molding operation. These failures to obtain a brittle product on cooling resulted even after eight or ten hours of refluxing the reaction mixture.

The abrupt changes or breaks in the curves, Figure I, may be likened to eutectics. The resins corresponding to the compositions represented at the breaks showed a wide divergence in properties from other resins in the system. For example, resins 4 and 23 which correspond to such compositions on the curve, possessed excellent molding qualities and the molded objects produced had an excellent appearance.

In general, the binary mixtures containing m-cresol form satisfactory resins while those containing o- and p-cresols are less satisfactory. The relative positions of the curves in Figure I indicate these facts. It will be noted further that the minimum time of cure for the binary systems occurs with the m-cresol and at about 50 mol per cent. The minimum time of cure was taken as that time required to produce a molded object which showed no discoloration after immersion in boiling water for 8 minutes.

The relationships between time of cure and temperature are illustrated in Figure II. (*Continued on page 71*)

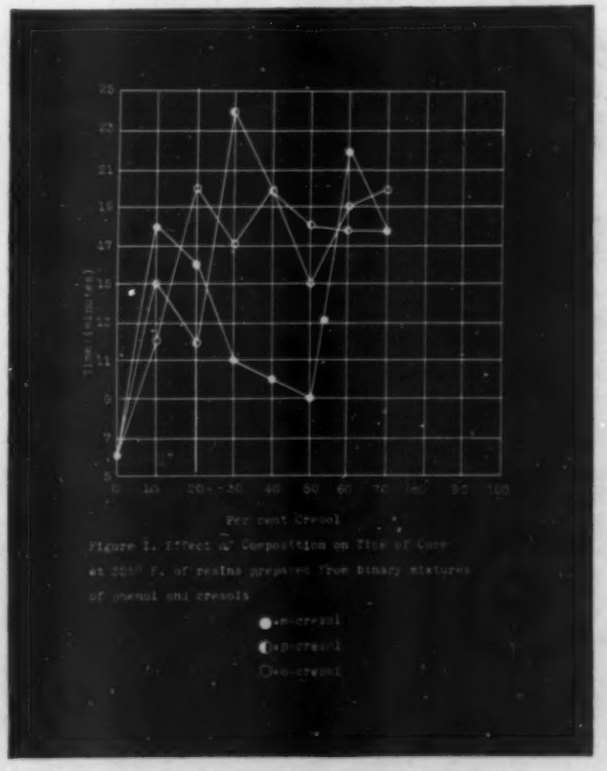


Figure I. Effect of Composition on Time of Cure at 325° F. of resins prepared from binary mixtures of phenol and cresols

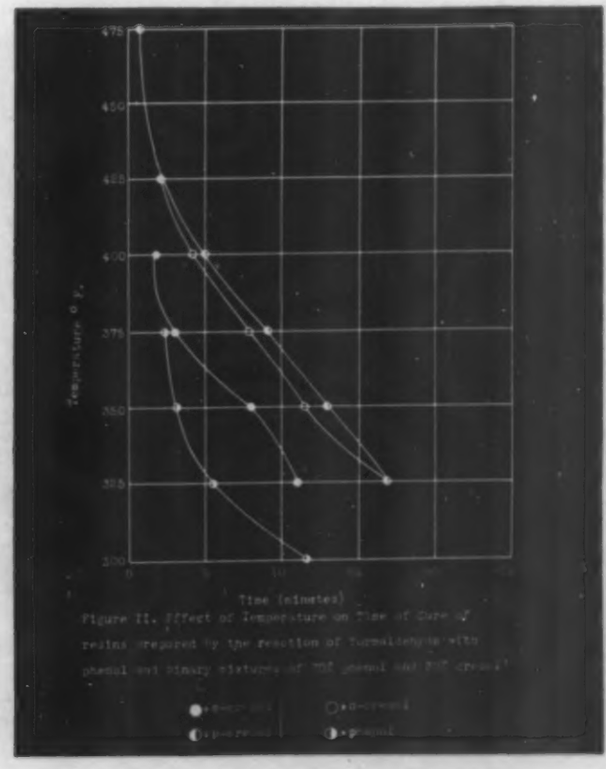


Figure II. Effect of Temperature on Time of Cure of resins prepared by the reaction of formaldehyde with phenol and binary mixtures of 70% phenol and 30% cresol

U. S. plastics patents

It is our plan to present on this page each month abstracts of Patents from the Official Gazette of the U. S. Patent Office. Those included this month appeared in the issues of January 5th, 12th, and 19th. Those appearing in the January 26th issue will be listed with those of the first three issues of February in our March number. Correspondence regarding them should be addressed to the Technical Editor, Modern Plastics, 425 Fourth Avenue, New York City.

RESINOUS COMPOSITIONS. G. D. Paterson (to E. I. du Pont de Nemours & Co.). U. S. 2,066,363, Jan. 5. Composition comprises modified polyhydric alcohol-polycarboxylic acid resin and an organic compound of mercury to prevent mold growth.

LAMINATED SHEET. K. Ripper. U. S. 2,066,421, Jan. 5. Impregnation of a cellulosic lamina with a solution prepared by mixing 1 mol of thiourea and less than 2 mols formaldehyde without addition of external heat in an aqueous medium which is more acid than $C_H = 10^{-6}$ and less acid than about $C_H = 10^{-3}$, drying the material without heating, and applying pressure and heat thereafter sufficient to form a hydrophobe resinous product therein.

METHOD OF PRODUCING SHEETS FROM UREA FORMALDEHYDE RESINS. S. Goldschmidt, E. Gerisch, W. Beuschel, and A. Muller (to T. Muller). U. S. 2,066,726, Jan. 5. The compositions are cast in closed molds composed of non-metallic material, and the solidified castings are dried after removal from the molds in a medium containing a controlled amount of the same solvent which is to be removed from the castings during the drying operation.

RESINOUS ADHESIVE AND PROCESS OF MAKING THE SAME. C. E. Rozema and J. H. Tigelaar (to Reconstruction Finance Corp.). U. S. 2,066,857, Jan. 5. Phenolic-aldehydic product mixed with a substantial quantity of blood albumen.

SYNTHETIC RESIN AND METHOD OF PRODUCING. I. W. Humphrey (to Hercules Powder Company). U. S. 2,067,054, Jan. 5. A reaction product of a pinene-maleic anhydride and an alcohol.

PIGMENTED GRANULAR POLYMERS. W. E. Gordon and W. W. Heckert (to E. I. du Pont de Nemours & Co.). U. S. 2,067,234, Jan. 12. In the manufacture of polymerized methyl methacrylate, adding soya lecithin in an amount equal to about three times the weight of pigment contained therein.

MANUFACTURE OF ARTIFICIAL RUBBERLIKE MASSES. E. Tschunkur and W. Bock (to I. G. Farb. Akt.-Ges.). U. S. 2,067,304, Jan. 12. Polymerization of butadiene (1,3) and alkyl-substituted butadienes in the presence of water and certain salts exerting a catalytic and emulsifying action.

CELLULOSE ESTER COMPOSITIONS, PARTICULARLY FOR MOLDING PURPOSES. H. A. Auden, H. P. Staudinger and P. Eaglesfield. U. S. 2,067,310, Jan. 12. Mixing cellulose triacetate and a lactide or anhydride of maleic, succinic and phthalic acids having a boiling point of at least 200° C., first mechanically and then with the aid of a solvent.

VINYL RESIN COATING. D. M. Gray (to Hazel-Atlas Glass Co.). U. S. 2,067,316, Jan. 12. The addition of about 2 to 12 per cent of a polyhydronaphthalene compatible with the lacquer and imparting the property of drying without forming permanent ridges.

SYNTHETIC PLASTICS. W. P. ter Horst (to Wingfoot Corp.). U. S. 2,067,465, Jan. 12. A vulcanizable composition comprising unvulcanized rubber, sulphur and the reaction product of an alkaline polysulphide, a polyglycerol halogenated hydrin and a di(halogenated alkyl) ether.

METHOD OF POLYMERIZING ORGANIC COMPOUNDS. O. Rohm (to Röhm and Haas Co.). U. S. 2,067,580, Jan. 12. Polymerizing acrylic and methacrylic acid derivatives in narrow cells, the walls of which are uniformly heated and maintained at a polymerizing temperature by a circulating fluid, the temperature of which is regulated to conduct away heat generated during polymerization, whereby overheating of the polymer and bubble formation is prevented.

ARTIFICIAL COMPOSITIONS. H. Fikentscher (to I. G. Farb. Akt.-Ges.). U. S. 2,067,706, Jan. 12. Subjecting a saponification product of a product obtainable by interpolymerizing an acrylic acid ester and such a vinyl ester as yields saponifiable polymerization products, to conditions under which lactone formation occurs.

SYNTHETIC RESIN AND METHOD OF PRODUCING. E. G. Peterson (to Hercules Powder Co.). U. S. 2,067,859, Jan. 12. Product of the simultaneous reaction of a terpene hydrocarbon of the formula $C_{10}H_{16}$ and possessing no conjugated system of double bonds, maleic anhydride and a compound containing the abietyl radical.

SYNTHETIC RESIN AND METHOD OF PRODUCING. A. L. Rummelsburg (to Hercules Powder Co.). U. S. 2,067,862, Jan. 12. The reaction product of a polyhydric alcohol, an organic polybasic acid or anhydride, and a hydrogenated abietyl alcohol.

COATING COMPOSITION AND METHOD FOR PRODUCTION THEREOF. J. Fletcher (to Plastergon Wall Board Co.). U. S. 2,067,910, Jan. 19. Varnish composition capable of forming a smooth finish on baking, comprising a solution of a phenol-formaldehyde resin, a resin from the group of polyhydric alcohol-polybasic acid esters, natural gum resins and the gasoline insoluble portion of oxidized abietic acid, a low boiling solvent and a phenol.

COMPOSITIONS OF MATTER AND METHODS. M. T. Harvey (to Harvel Corp.). U. S. 2,067,919, Jan. 19. Reaction of cashew nut shell liquid and 1-5 per cent by volume of concentrated sulphuric acid.

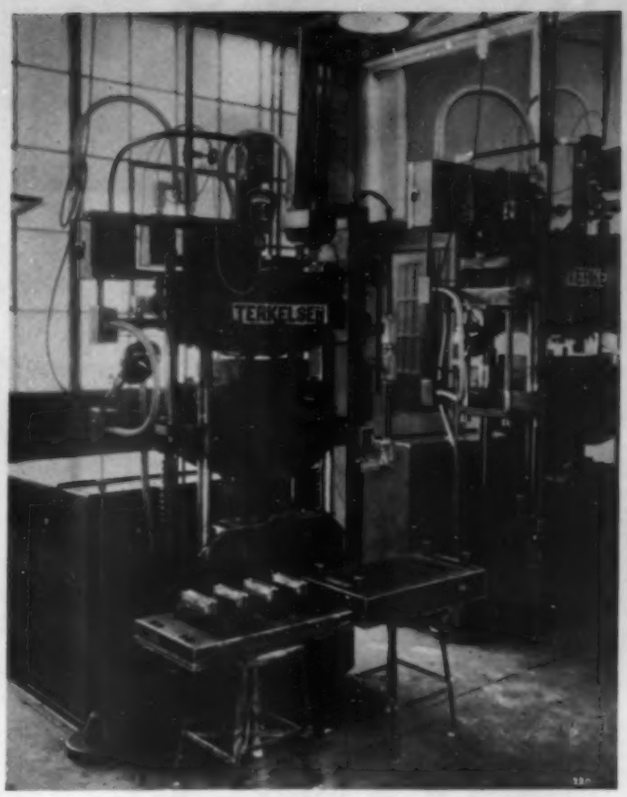
WATER RESISTANT MOLDED ARTICLES AND METHODS. C. A. Nash (to Bakelite Corp.). U. S. 2,067,941, Jan. 19. Incorporation of up to 5 per cent by weight of water in a hot-molding phenol-formaldehyde composition yields articles characterized by resistance to distortion from contacting liquids.

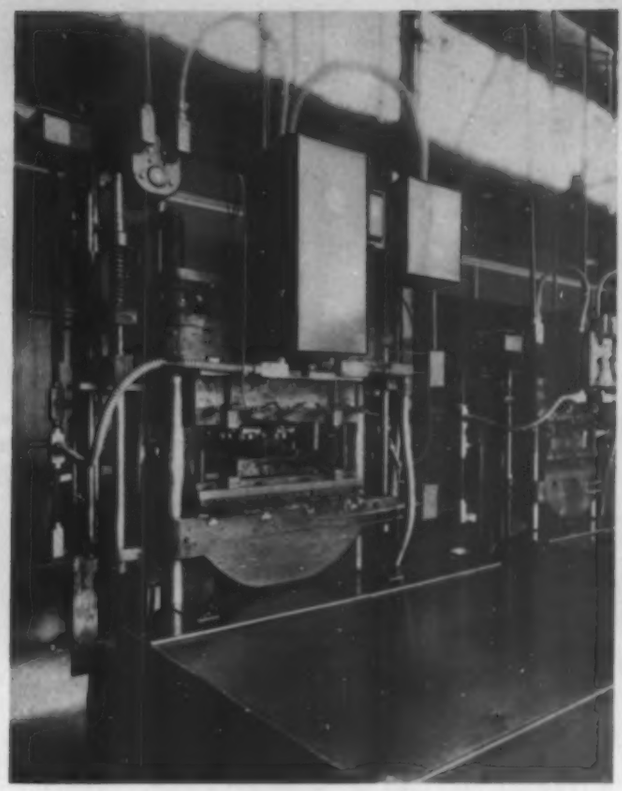
PROCESS OF MAKING CELLULOSE DERIVATIVES. N. Picton (to Imperial Chemical Industries, Ltd.). U. S. 2,067,946, Jan. 19. Preparing ethylcellulose by reacting 100 parts of cellulose having a compactness of about 90, granule dimensions of about $\frac{1}{8} \times \frac{1}{16} \times \frac{1}{16}$ inch and an apparent bulk density of about 15 pounds per cubic foot with about 300 parts of ethyl chloride in the presence of about 240 parts of solid caustic soda, 120 parts of water and 500 parts of benzene at a temperature of about 150° C. during about 8 hours, and isolating and purifying the resulting ethylcellulose.

POLYMERIZATION PRODUCTS. H. Mark, H. Fikentscher and G. v. Susich (to I. G. Farbenind. Akt.-Ges.). U. S. 2,068,424, Jan. 19. Polymerizing aqueous emulsions of vinyl halides in a closed vessel.

POTENTIALLY REACTIVE SYNTHETIC RESIN FILM. A. H. Bowen and T. W. Dike (to I. F. Laucks, Inc.). U. S. 2,068,479, Jan. 19. A self-supporting non-reinforced potentially reactive adhesive film of reaction products of zinc chloride with urea and an aldehyde.

REACTION PRODUCT AND PROCESS. H. A. Bruson and L. W. Covert (to Rohm and Haas Co.). U. S. 2,068,634, Jan. 19. Resin or balsamlike material prepared by heating a perhydro derivative of a diarylol methane compound with an organic monocarboxylic acid.





Front and rear views of electrodraulic presses in Square D molding department in which electricity is used for both heat and power

MOLDING WITH ELECTRIC HEAT

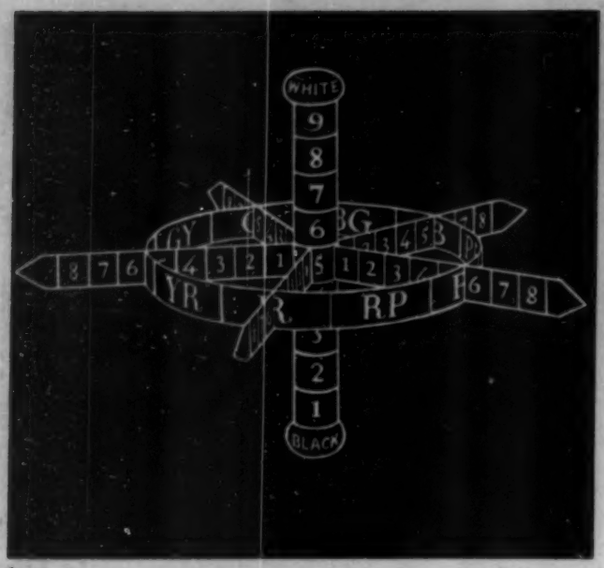
Although steam is generally used to heat molds here is one company which prefers electricity and tells why

WHEN THE SQUARE D COMPANY STARTED A phenolic molding department in its Insulation Division factory at Peru, Indiana, one of the first problems to come up was how to heat the molds for the large electrodraulic presses. There were three of these presses—two 100-ton and one 50-ton.

The advantages of steam versus electric heat were carefully weighed, and in spite of the fact that all of the molds owned by the company were cored for steam, the evidence was overwhelmingly in favor of electric heat. Here are some of the reasons. The only steam available was not sufficiently high pressure to give the desired temperature. Therefore, if steam were to be used, the company was confronted with the necessity of installing a new high-pressure steam boiler. Moreover, the company would be required to install a considerably larger boiler than would be necessary at first in order to provide for the addition of other presses as needed. On the other hand, since the company enjoyed a very reasonable power rate, it was felt that the economy of operation with electric heat as compared with steam would amply repay the initial investment of adapting the molds so that they could be heated electrically.

The required electric heating capacity for the various molds was determined by the Edwin L. Wiegand Company, electric heating engineers, and the correct chromalox electric heating units of strip heater type installed in the molds along with automatic temperature controller.

The Square D Company has found that the expense of adapting steam heated molds received from other plants for electric heat is much less than would have been the cost of installing a steam plant. Even had it proved more expensive, the savings from electric heat operation soon would have wiped out the difference for one of the major economies of such operation is elimination of boiler operation with its necessary attendants. In addition, the presses can be operated 24 hours a day much more readily than they could (*Continued on page 61*)



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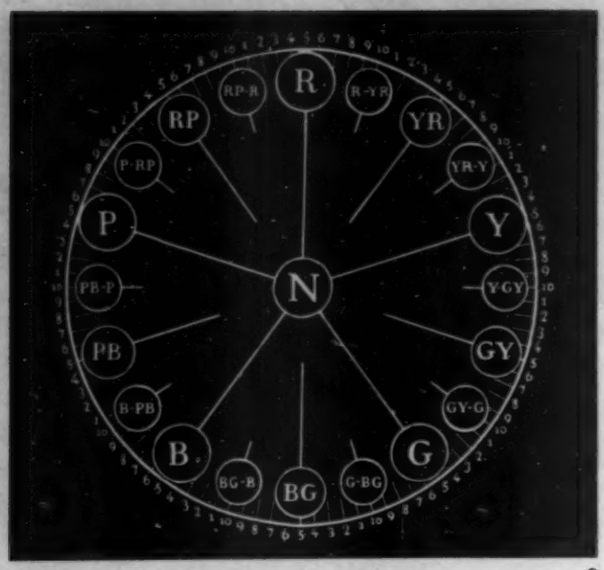


2

1. Diagram showing hue, value and chroma in their relation to one another. The circular band represents the hues in their proper sequence. The upright center axis is the scale of value. The paths pointing outward from the center show the steps of chroma, increasing in strength as indicated by the numerals. 2. The hue circuit of the Munsell System of color notation showing the placing of 5 principal hues, 5 intermediate hues, and the division of each for exact description

THE MUNSELL SYSTEM OF COLOR SPECIFICATION

Since cast and molded plastics measure much of their importance to industry by color, we publish this abstract of a paper presented by Walter M. Scott, Ph.D., service director of Gustavus J. Esselen, Inc., before the Conference on Color at Massachusetts Institute of Technology, on July 24, 1936

GROWING USE OF COLOR IN MODERN INDUSTRIAL products emphasizes the need for a simple, accurate method of describing colors.[1] The traditional comparison of a color with that of some natural object (brick red, rose pink, apple green, sky blue) lost its usefulness with the multiplication of hues produced synthetically. The scientifically exact spectrophotometric method is too cumbersome to meet the day to day needs of industry. Several methods of color description have been proposed in the past, all of them designed to help in this otherwise difficult problem. Of these, the system of color notation devised by Munsell and already widely used comes nearer to the ideal as an everyday working tool than any other. Certainly its value has been amply proved under modern industrial conditions.

The basis of Munsell's system is the evaluation of each color according to its three psychological attributes which may be termed dimensions for want of a better word. These are: value, by which is meant the net light reflective power of the color; hue, which determines its position in the spectrum; and chroma, which designates the strength of the characteristic color.

To make clear the meanings of these terms and their relations to each other, all colors are conceived to make up a "color sphere." The vertical axis of the sphere extends from white to black through all variations of neutral gray to be obtained by mixing pure black and pure white in all proportions. Around the circumference of such a sphere can be arranged all the pure spectral colors, and between the circumference and the vertical axis the intermediate strengths can be laid out along the sphere's radii. In this manner all possible colors can be arranged so that the position of any one of them within the sphere accurately represents its characteristics. This determining position can be completely described by its three dimensions which so fix it that only one color can fit a single description.

The whole system is based upon the ability of the human eye to distinguish color characteristics, and since it is to the eye alone that colors appeal, the result is accurate for all color applications. The concept of colors arranged in such a sphere was not new with Munsell, having been suggested by Runge as early as 1810. However, to this earlier idea, Munsell contributed the conceptions of equal steps of hue, value and chroma, and of color balance, which makes his system workable.

For a notation of value (*Continued on page 68*)

[1] See editorial in MODERN PLASTICS, August 1936, page 24.

Graham dash panel, ash-tray covers, knobs, molded of TENITE by General Industries Co. Knobs also by The Richardson Co. and Sinko Tool & Mfg. Co.

TENITE

FOREMOST among plastics for interior motor styling, Tenite finds a new use in this molded dash panel of the 1937 Graham. Control knobs, cigar lighter, and ash-tray covers of Tenite complete the assembly. Graham designers chose Tenite for their purpose because of its exceptionally high strength, beautiful coloring, and smooth lustrous mold finish. A 52-page illustrated book describing the molding characteristics of Tenite and its many industrial and decorative uses will be sent you on request.

TENNESSEE EASTMAN CORPORATION *(Subsidiary of Eastman Kodak Co.)*, **KINGSPORT, TENN.**

Plastics patent information

Nonslip soles and heels for shoes are made by firmly bonding a slip-resisting rubber or celluloid tread surface to a rigid base which may be made of a synthetic resin such as Bakelite. The rigid base may be grooved or serrated to improve the adhesion of the tread layer, which may be attached with any suitable adhesive cement. In addition to being useful for footwear, laminated articles made in the specified manner can also be formed into feet or bases for ladders, typewriters and furniture or into treads for automobile running boards. (G. E. Bowser and W. Harding, British Patent 450,151.)

●

An improvement in the manufacture of abrasive disks and other grinding shapes makes use of very finely divided abrasive powders, for example such as will pass a 200-mesh screen, in admixture with suitable proportions of coarser particles up to a size which will just barely pass a 40-mesh screen. The filler may be composed of mulled particles of fused quartz, alumina or silicon carbide, all of which (especially the last named) are very hard and form excellent abrasives. The size distribution of the fine and coarse particles improves the performance characteristics of abrasive disks made by the new method, and the heat-hardenable binder (which may be Redmanol or the like) is a superior material for making grinding wheels. (Carborundum Co., British Patent 450,445.)

●

Sheet asbestos goods, made by sheeting asbestos with slaked lime and pyrolusite (manganese dioxide), do not have sufficient mechanical strength for many of the uses for which asbestos is particularly suitable. Where high mechanical strength is required in heat insulation and in fireproof materials, a polymerized hydrocarbon has been found to give excellent results. The binder is introduced into the asbestos goods by impregnating the sheets with divinylacetylene and drying at a temperature at which the resin is formed. (M. I. Belorukova, Russian Patent 47,080.)

●

Pulleys on which belts will not slip, and self-lubricating bearings or other machine parts, are made from a phenolic resin and a fibrous filler. The novelty in this invention lies in carrying the initial condensation of the phenol and formaldehyde to a stage at which the resin will envelop but not permeate the textile scrap or like material which is used as the filler. Shaped articles made from this composition have a roughened surface which makes them useful for nonslip power transmission pulleys and a porosity which enables them to absorb and retain oil when used as self-lubricating machine parts. (S. A. Usine Belge de Materiel Electrique Vynckier Freres et Cie., Belgium, French Patent 790,743.)

Economic conditions having favored synthetic plastics over metals in recent years, much progress has been made in Germany in the design and use of molded bearings, even for heavy machinery such as rolling mills. Recent improved designs include bearings for screw conveyors, stuffing boxes for a 10-ton crane, axle bearings for narrow gage railway cars, bushings for rope pulleys, shafting bearings, axle bearings for cars used in factory transport, and various others. The higher initial cost of the molded resin bearings is more than offset by economies in power consumption, lubricants and replacement. There are a number of expedients for circumventing the difficulties introduced by the low thermal conductivity of molded bearings. (Otto Achilles, Zeitschrift des Vereines deutscher Ingenieure, Oct. 31, 1936, pp. 1317–20.)

●

Finger stalls which give perfect protection to injured fingers and can be medicated to promote healing are made from a polyacrylic acid or polyvinyl alcohol resin. The finger stalls are shaped by dipping a form of suitable dimensions in a 20 per cent solution of the resin. A novel feature is that the finger stall is made of two parts, one to slip over the finger as a holder for the closed end portion; and both parts are molded with a screw thread at the end for ready attachment of tip to holder. The resin may contain a small proportion of a softener such as butyl phthalate. A tape made of the same resin but with more softener (about 5 per cent) may be coated with adhesive and used for firm attachment of the entire finger stall. (E. Sander, Sander's Chemical Products, Ltd., 43 Regent St., Loughborough, England; British Patent 446,944.)

●

Blends of synthetic resins and nitrocellulose are effectively used in a novel method for making box toes and other shaped shoe stiffener parts on a hair, paper or wool felt base. The fibrous material is first impregnated with a solution of a phenol-formaldehyde resin (which may contain a small proportion of nitrocellulose). After drying, the impregnated material is again impregnated with a solution of a mixture of nitrocellulose and a synthetic resin in a mutual solvent. This solution may also contain a plasticizer. The blanks thus prepared have excellent mechanical properties. For use, they are softened with a solvent such as acetone and pressed between the shoe upper and lining. (R. Haupt, Albersweiler, Pfalz. Germany; British Patent 451,467.)

●

A locket, to be worn on the person for medicating a specified spot with iodine vapor, is molded in a suitable locket form from any plastic material which is impervious to and not chemically affected by iodine and its vapor. One end is left open for inserting the charge of iodine; when the locket is filled the open end is sealed with a porous plug of Portland cement and powdered pumice, which will retain the solid iodine but will allow the vapor to escape to the spot to be medicated. (F. V. Cliffe, Pembury, Hammers Lane, Mill Hill, London; British Patent 451,869.)

●

Electrical fittings such as high frequency iron cored coil formers, switch cam shafts, valve bases and sockets, holders for condenser plates or for switch contact fingers, and the dielectric layer in condensers, are made of a molded mixture of polystyrene and insulating powder which has a very low loss angle. Quartz and mica, having loss angles in the neighborhood of 0.00025, are suitable. Metal contact inserts may be molded into the shapes. Fittings made in this way have good mechanical as well as electrical properties. (H. Vogt, 69 Steglitzerstrasse, Berlin-Lichterfelde, Germany; British Patent 452,768.)

●

Thermoplastic materials such as cellulose acetate or nitrocellulose are molded into elongated articles by heating under pressure until the material is soft, in a chamber with about the same cross section as the blank, and extruding into a die cavity which tapers so that the blank is supported laterally while it is progressively molded to the desired shape. Decorative bands can be inserted in the die before molding, and pearl essence may be included in the composition for nacreous effects. The method is excellently adapted for making umbrella or cane handles, pencils, fountain pen barrels or caps and like articles. When the product is to be hollow (e.g., a fountain pen barrel) a mandrel is supported within the die so that the softened thermoplastic material flows around the mandrel, forming a ring in the space between the mandrel and the inside wall of the die. (Celluloid Corp., Newark, N. J., British Patent 452,873.)

●

Cheap plastics which have many uses for making molded shapes can be made from waste wood or peat or other cheap cellulosic material by reducing it to the desired fineness, incorporating this filler in a solution of a resin and molding at a temperature of about 300–320 deg. F. The resin solution may be, for example, a Novolak type of phenolic resin in a solution containing also furfural and hexamethylenetetramine. (M. V. Zobolevski, P. V. Olenin and A. A. Peshekhonov, Russian Patent 47,078.)

BACKSTAGE

Corner of the du Pont exhibit at the New York Lamp Show in which their lampshade material was featured

New York Lamp Show

New finishes and colors of Sundora, the du Pont Company's lampshade material, were dramatically presented in that company's exhibit at the New York Lamp Show held at the Hotel New Yorker last month under the George F. Little Management. The full range of colors obtainable in Sundora was exhibited on a large half-cylinder display with stripes of the shade material, behind which a rotating light made the circuit of the colors. Various types of lamps were equipped with appropriately styled shades and were placed beside large four-color photographs of home interiors and room settings in which the same lamps were a harmonious part of the decorative scheme. The photographs—many of them reproduced from national magazines—were set into wall niches and were cleverly lighted from behind giving the effect of lamp-lit rooms. In this way the du Pont Company showed how each unit could be used, and still more interesting how modern lampshade materials are appropriate for any type room whether it is English, French or Colonial.

Notable was a new linen finish which was effectively used in a shade from Nu-Lite Manufacturing Company, made up in Ming Gold with an applied edging of brown and white braid at top and bottom. This shade was shown on a white lamp and pictured in a Colonial living room arranged by James McCutcheon & Company and featured in *Good Housekeeping*.

A corner of the du Pont Exhibit is illustrated here. Two styles from Paul Hanson Company are featured at the left: a shade of rust in mat finish and high-gloss inside, used on a candle-style lamp; and a white shade of the same finish with blue-green binding, shown on a turquoise blue pottery lamp. The color photograph illustrating the use of these lamps is of the Manet Room, Decorator's Picture Gallery, as carried out by Elsie Cobb Wilson, to show the adaptability of the material.

The third shade which is from Stone, Rolfe & Company shows the new linen finish of this washable plastic material, in blue with white mossy braid edging and

glossy inside surface. Illustrated in a bedroom arranged by Marshall Field & Company and shown by *Better Homes and Gardens*.

Pleated and decorated lampshades of acetate material were seen in many exhibits at the Show. But the outstanding use of plastics was accomplished by Steel and Johnson Mfg. Company. Copper-tone stems combined

Two views of the Celluloid Corp. exhibit

with fluted white Catalin bases, desk and wall lamps with yellow Beetle molded shades, molded reflectors, as well as simulated tortoise shell of cast resin combined with copper-tone: these were some of the treatments of the materials.

The Celluloid Corporation, too, had an attractive exhibit showing how Lumarith shades can be used in combination with alabaster, Venetian glass, Chinese porcelain and wood. Behind each lamp drapery fabrics were hung showing the color scheme which would best harmonize for a complete ensemble.

Mipolam from Germany

A new thermoplastic polyvinyl chloride material for pipes and tubing, called Mipolam, was recently introduced by Dynamit A. G. Pipes of the new material are being laid in chemical and rayon plants and in beer breweries to convey acids, alkalies, brine, formalin, alcohol, beer, etc. Its advantages are an unusual resistance to most all acids and lye solutions, mechanical durability,

BACKSTAGE

flexibility, light weight and facility in installation. Mipolam pipes are replacing brittle glass and inflexible earthenware pipes as well as iron and non-corroding steel pipes. The new pipe can be sawed and bent with ordinary tools. It is non-inflammable but becomes soft at 80 deg. C. so that it can be formed. Two pieces can be easily joined by heating one end until it becomes pliable and then inserting the cold end of the other. In cooling, the warm end shrinks to fit the cold end tightly, and after a thin coat of a solution "PC 20" is applied to the cold end, is reinserted and becomes inseparable.

Catalin Limited

E. J. Luster, director of the American Catalin Corporation has recently returned from England where he spent several weeks in connection with the establishment of Catalin Limited whose headquarters are at 2 and 3 Charterhouse Square, London. This company manufactures cast synthetic resins and markets same under the trade name Catalin.

Mr. Luster, as a director of the new company, will spend much time in England as general advisor of Catalin Limited and will represent the American corporation at his London office.

General Plastics booth

General Plastics booth at the Chicago Paint Show displaying the phenol-formaldehyde molding compound, Durez, and resins in synthetic industrial finishes.

Revolite moves to Stamford

Atlas Powder Company announces the acquisition of Revolite, formerly manufactured by the Revolite Corporation, a subsidiary of Johnson & Johnson, New Brunswick, New Jersey. The manufacture of "Revolite" will be moved to Stamford, Connecticut, where the business will be conducted by the Zapon Division, Atlas Powder Company. M. J. Creighton, general manager will direct the new enterprise.

Revolite is the registered trade name of a fabric coated with a flexible Bakelite resinoid. It presents remarkable qualities of beauty and utility, and is made in a wide variety of metallic finishes and striking colors. The material is well-known in the interior decoration and upholstery fields. The extreme durability and permanence of this Bakelite resinoid-coated material should make it applicable to many industrial uses where its high resistance to heat, alcohol, soaps, oils and chemicals provides properties not obtainable in the older types of coated fabrics.

Atlas is taking over Revolite personnel in both sales and manufacture. Gustav Gurska is general sales manager of Zapon Coated Fabrics. William A. Michie, who has been associated with the Revolite Corporation, will be in immediate charge of Revolite sales.

Celluloid opens Detroit office

The Celluloid Corporation announce that they opened an office at 512 Stephenson Building, Detroit, Mich. This office has been established to provide technical help, color development, and such service as may be required by users of Lumarith and Celluloid in that area.

Howard Dunk moves

The Resale Price decision of the U. S. Supreme Court, (and the effect of the Robinson-Patman Bill) has so increased interest in premium advertising that Howard W. Dunk, for over 25 years associated with the largest operators in that field—has opened an office at 500 Fifth Avenue, New York City, as an independent, expert consultant in and creator of sales promotion and merchandising plans predicated on the use of premiums.

For many years, Mr. Dunk was with the United-Profit-Sharing Corp., as vice-president, and since that time he has been associated with Nestle's Milk Products, Inc., and the Colgate-Palmolive-Peet Company, two of the largest present users of premium advertising.

New hydrocarbon resin

The Neville Company announces a new and unusual resin called Nevillite. It is a crystal clear thermoplastic hydrocarbon resin with uncommon resistance to after-yellowing influences and is suited to a number of industrial uses, especially in the finishing and enameling field. A folder setting forth its properties and proposed uses is available to our readers.

Gregory joins Farquhar on hydraulic presses

D. J. Gregory, who has had rich experience in both Europe and the United States as a designer of high speed hydraulic presses, joins A. B. Farquhar Co., Limited, as chief engineer of their Hydraulic Press Division. The Farquhar Company, with a background of 80 years of manufacturing experience, is expanding its hydraulic press division, which includes high speed production presses, hot and cold process presses, and others.

BACKSTAGE

In Europe, Gregory's experience includes that with the Krupp plants in Germany, and the Putilov Works in Russia, while that in the United States includes Bethlehem Steel, Southwark Foundry & Machine Co., Birdsboro, Farrel Birmingham, and Baldwin-Southwark. He has developed new, modern hydraulic presses for the rubber, plastic materials, metal trades, fiber, veneer, paper, aviation, electrical, and hardware industries.

Flamenol, a new insulation

Flamenol, a polyvinyl chloride, is a new flexible synthetic plastic, rubberlike in many respects yet differing from rubber in so many of its properties as to make it outstanding as an electrical insulating and cable-jacketing medium. The material can be extruded by the conventional rubber tubing machine and, of course, requires no curing. Flamenol is manufactured by the General Electric Company.

Sales manager appointed

General Plastics, Inc., announces the recent promotion of Al Hanmer to sales manager of Durez, their molding compound. Mr. Hanmer formerly represented the company in the Chicago, Detroit areas.

Available from stock

With the increasing use of molded ureas in the lighting fixture field many of our readers will be interested to learn that the reflector pictured here is available now from stock molds.

This reflector has a molded thread to fit a standard socket, is $5^3/_4$ in. high and $5^1/_2$ in. in diameter and is available in an off white shade which is the equivalent for light transfusion to opal glass.

The recent Lamp Show gave ample evidence of the extensive use of these urea materials and indicated the trend they have established to replace glass wherever they are practical to do so.

It is a well known fact that plastics will not replace glass in many applications but in the use of reflectors such

as these, plastics are much lighter than glass, considerably less fragile, with the resulting economy in assembly and shipping which is rapidly attracting the attention of the entire lamp industry.

Fixtures of the sort illustrated can be turned either up or down depending upon the type of lighting fixture contemplating their use, and since they are available without mold cost, their price in reasonable quantities will be sufficiently low to attract many new users. They are being molded of both Beetle and Plaskon by the Plastic Molding Company.

Amicable agreement

Patent litigation between the American Cyanamid Company and Plaskon Company, Inc., in the urea resin field has been terminated, the two companies having granted each other licenses under their respective patents.

Changes at Celluloid

Changes in the sales organization of Celluloid Corporation effective Jan. 1, 1937, were as follows: E. W. Ward, who a year ago relinquished his post of district manager of the Chicago office to assume that of director of sales of the packaging division, has now been promoted to a newly created post of assistant general sales manager. Mr. Ward has been with the company since 1921 and in that period has seen service in practically every activity of the company. D. S. Hopping has been promoted to succeed Mr. Ward as director of sales of the packaging division. Mr. Hopping's former activities were in the fields of purchasing, sales, advertising, publishing and operating of his own business for a short while.

Competition for American jewelry designs

As part of a movement to give prominence to American jewelry styles, a Competition for American Jewelry Designs was announced recently by *The Manufacturing Jeweler*, a trade publication of the manufacturing jewelry industry. Cooperating in the conduct of the competition are representative associations of the industry. Cash awards have been offered by the New England Manufacturing Jewelers' and Silversmiths' Association, the Rolled Gold Platers' Association, the Metal Finding Manufacturers' Association and *The Manufacturing Jeweler*. The Rhode Island School of Design, prominent institution for teaching commercial and industrial art and design, is playing an important part in the program.

New thermosetting phenolic resins

General Plastics Inc. announces a new line of improved thermosetting phenolic resins in both liquid and powdered forms designed for numerous industrial bonding applications. Certain types, when used with rubber and drying oils or by themselves in impregnating or bonding loose or woven asbestos, give the finished product a higher heat resistance, more strength and a

uniformly stable coefficient of friction. Other resins in this series are used to improve the properties of fixed resistance units or the bonding of ground cork in the production of stronger, more flexible and more heat-resisting gasket stock. Still other forms are used for the production of laminated tubes using the dry resin process with excellent results.

Du Pont convention

Convention of management, sales, advertising and production executives of the E. I. du Pont de Nemours Company, Inc., snapped at a dinner held at the Hotel New Yorker last month. On the following day the entire group visited the Plastics Department plant at Leominster, Mass.

Du Bois with Gorham

J. H. Du Bois, formerly in charge of sales in the Chicago area for the General Electric Company, Plastics Division, is now covering that area for the Plastics Division of the Gorham Company. He is located at their Chicago office.

Conner to speak on plastics

B. Franklin Conner, general manager of the Plastics Division of Colt's Patent Fire Arms Mfg. Company, will lead a tour into possible future developments in plastics when he speaks to the Hartford Chapter of the American Society of Mechanical Engineers at the Hartford Electric Light Auditorium this month.

Loeffler now with Monsanto

A. T. Loeffler, who has for many years been associated with the Hooker Electrochemical Company, resigned some time ago, and has accepted a position in the Monsanto Chemical Company's New York Office.

Opens Chicago office

Robert Heller, New York industrial designer and stylist, has opened a Chicago office at 104 South Michigan Avenue. Mr. Heller, has, during the past year, widely extended his activities and the new office will greatly facilitate the handling of mid-western accounts.

BOOKS OF THE MONTH

Booklets reviewed in these columns will be sent without charge to executives who write for them on their company letterheads. Other books will be sent postpaid at the publishers' advertised prices

Henley's Formula Book

The Norman W. Henley Publ. Co.
Price $4.00

This complete book of more than 10,000 formulas, processes and trade secrets on a wide variety of subjects, contains also newest methods, latest developments and entirely new sections. It contains practical and technical formulas for making adhesives, beverages, bleaches, concrete, essences and extracts, hair preparations, insecticides, jewelers' formulas, lacquers, paints, pastes perfumes, photography, varnishes and wood preservation as well as including money saving ideas.

Instructions are simple to follow. A Buyers' Finding Guide appears in the front section of the book. It tells where to buy the various ingredients necessary for making the particular formulas you are interested in. The 1937 edition contains about one hundred more pages of important new formulas than the previous edition.

Typography, Volume I

Typography, published quarterly by the Shenval Press, 58 Bloomsbury Street, London (two dollars annually in America), and sponsored by James Shand, Ellic Howe, and Robert Harling, made its debut in November, '36. Volume I reached me just before the holidays and I purposely reserved comment until I could spend some time in its pleasant company. Typography, since the day type first became movable, has been an engaging subject worthy of constant experimentation and discussion and in this day of enlightened appreciation of design, type arrangement is of such paramount interest that none can afford to disregard its possibilities of persuasion in any printed presentation.

In this regard, *Typography* is indeed refreshing. It begins with an enameled cover of gentle blue, edged in white, and plastic binding, and is labeled meticulously in the approved Modern. Its content is well chosen and delightfully printed. The plastic binding (please pardon this reference) provides splendid accommodation for specimen insertions and makes for easy handling in use. Space balance and color contrasts throughout give one a sense of comfortable reading although some of the specimens appear a bit heavy to an American eye.

"It is our hope and belief that *Typography*," say its authors, "will prove to be the most stimulating and welcome journal of typography in England; acknowledging sound traditions; welcoming adventurous use of new materials and new forms; not afraid to accuse the stagnant traditionist or to condemn the spurious modernist." A worthy program, we might add, which should find numerous ardent readers in America.

BOOKS OF THE MONTH

Technical equipment

Two booklets have recently been published by the Gaertner Scientific Corporation. The first "Optical Instruments," Catalog L-2 is eighty pages and discusses spectrometers, spectrometer accessories, spectroscopes, special eye pieces and lenses. The second, "Universal Laboratory Supports and Supplies," contains sixty-four pages and includes descriptions of supports, clamps, scales and other such tools.

Sifting standards

A four-page folder describing new standards in sifting is available from the Abbé Engineering Company. Illustrations of the sifters are included.

Alnor pyrometers

The Illinois Testing Laboratories has published a four-page folder describing their line of pyrometers. It also explains the uses of thermo-couples for molding and so forth, containing prices and specifications.

R & H Chemicals

The new Quarterly Price List of R & H Chemicals has just been issued by this division of E. I. du Pont de Nemours & Co., Inc.

DISPLAYS MUST BE MODERN

(*Continued from page 27*) these displays," said Mr. Kayton, "because of the strength of the material and because they retain their original luster even in unusually hard service."

We then asked if he used plastics in the exhibition booths which he had built. "Yes," he replied, "recently we did a booth for Philips Metalix. The background of the exhibit consisted of lighted X-Ray pictures above which we wanted a sharp dark contrast to serve as frame. We used black phenolic laminated material as panels because of its luster, and these were joined together with polished aluminum strips. As a secondary contrasting decoration we inserted a wide band of ivory laminated below the pictures. Plastics were also used in the center of the booth in the form of a red triangular shaped piece with an ivory laminated inlay. This made an attractive background for the three X-Ray instruments which were mounted on to be prominently displayed."

"Johnson and Johnson," he continued, "also had an exhibit which needed to be unusually sturdy because it was designed to travel. The black counter tops as well as the famous 'red cross' over the center of the booth were laminated phenolic. Below, a semi-circular stepped platform was arranged upon which merchandise

Johnson and Johnson display using laminated plastics

was placed. This platform was made of ivory laminated, with which the red and black formed a striking and decorative contrast."

We asked if he had used plastics on any other signs and to just what extent he found the materials useful.

"Oh, on many," he replied, "and we frequently combine plastics with metal with splendid results, as we did in the Bagatelle sign. Here we used a laminated sheet over wood for the base and the brass letters are screwed on. The result is a substantial and attractive sign that will be read.

"As far as the use of plastic materials in the display field is concerned, it is not exaggerating to say that they are indispensable. They have less tendency to warp than other material of comparative weight and strength. We can find no material which has truer colors or a more perfect and uniform finish, and the best of it is—it is not an applied finish but is already there when we buy the material and it goes all the way through. The fact that they resist burns, and cleaning solutions, that they do not chip or crack and cannot be injured easily is of utmost importance. The effects that inlays make possible, give the displays character and a rich appearance which lacquers and wood cannot approach. The surfaces are equal to glass without the danger of breakage. As a matter of fact, I can say that it is through the use of plastic materials that we have achieved much of our success in modern displays."

LIGHT IN THE AUTOMAT

(*Continued from page 21*) be moved quickly between 12 and 2 o'clock which are the "rush" hours.

The fixtures illustrated are the result of careful study and engineering by E. Lewis Dales for Ralph B. Bencker, architect for the Horn and Hardart cafeterias. These "light" machines, as Mr. Dales calls them, are beautifully executed in slender steel rods, welded into forms and each component attached with spinnings. The fixtures are polished, coppered and then nickle plated.

The wattage used depends upon the intensity of light desired but generally runs between two hundred and five hundred watts. Suitable dispersion is obtained by using a ribbed glass plate over the light source and supported by an RLM reflector.

The decorative sides of the light machines are made of Lumarith, a cellulose acetate product of Celluloid Corporation, arranged in composite formations to give beautiful combinations of pastel and translucent mottles. Units are arranged with blending colors on the top and bottom sections with the central unit composed of Lumarith mottles. The complete fixture is then bordered with strips of the same material in deep harmonious shades. The lighting fixtures are manufactured by Warman & Cook Co., who have done much work in the adaptation of plastics to lighting fixtures.

A TRANSPARENT PHENOLIC MOLDING COMPOUND

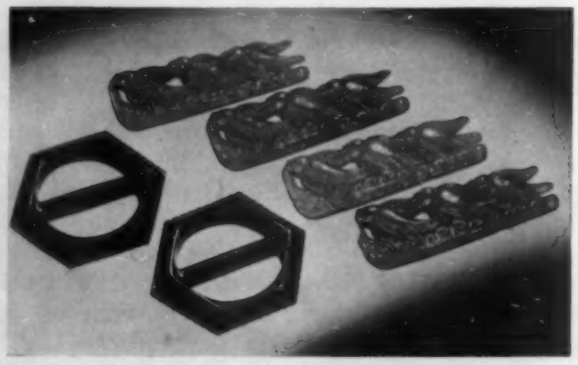
(*Continued from page 37*) formula as a matter of fact will prove suitable for all purposes, but by simple changes it can be made to meet many specifications.

This material combines the transparency, translucence and color variety of cast resins with the practicability of molding. It gives to buttons, buckles and such ornaments the advantage to withstand the heat and other damaging contingencies incidental to laundering. It is a thermosetting material unaffected by any reasonable heat.

Molding the new material is simple. Either powder or preformed pills may be used. Non-corrosive steel or chrome-plate molds are best for perfect workability of the material. The requisite temperature will vary, depending upon the article and color being molded; however, 300 to 315 deg. F. represents a suitable working range. The pressure is also dependent on the item molded. For normal to large objects the scale ranges from 2000 to 2500 pounds per square inch. Curing time in the mold varies as to color, but from 3 to 5 minutes is required. The product can be removed from the open press by air blasts or automatic knockouts. The material copies the mold faithfully even to its polish. Upon removal, the product is found to be odorless, tasteless, and of a high degree of hardness.

From production mold to the finished article is only a small step. A thin flash requires removing; this may be accomplished by buffing or tumbling. Little or no polishing is required. This brings the object out of the mold practically ready for shipment, and is a large factor in economical long run production. It is possible, of course, to mold letterings, threads, ribs, carv-

Buckles and brooches of a new transparent molded phenolic



ings and the like, as with any good molding compound.

As to the use of the material and its future, the field is nearly unlimited. Due to its warmth and beauty of color, as well as its transparency, it brings new possibilities to the designer of high class novelties and jewelry. Electrical insulation parts, automobile knobs and accessories, structural tile, electrical control devices, spools, lipstick holders, powder and rouge containers, trays, lampshades, shoeforms and creamers, are a few specific items easily molded with Uniplast.

A complete line of translucents, opaques, mottles and fluorescents is available and the color of course is integral as in all molding compounds. Since it is not applied it cannot wear, peel, or chip off. Many interesting and unusual decorative effects are possible because of its transparency. Dry pigments, for example, or metallic powders may be mixed with the dry compound, either in the preformer or in the mold giving a mottled effect of brilliance to the finished parts. Striations of intriguing patterns frequently result. Strong brilliant dyes give the molded part the appearance of colored glass with none of its fragility.

Laboratory tests gave the following results:

Specific gravity	1.27
Specific heat (cal. per °C. gram)	.357
Warpage	none
Shrinkage	none
Hardness (Brinell)	50
Moisture content (24 hrs.—100 ° C.)	2.86%
Water absorption (immersion 48 hrs., 25 ° C.)	.29
Burning rate	non-flammable
Effect of age	no effect
Effect of light	practically none
Effect of weak acids	no effect
Effect of strong acids	no effect
Effect of weak alkali	no effect
Effect of strong alkali	slight pitting
Effect of solvents (7-day test)	
Ethyl acetate	no effect
Amyl acetate	
Petroleum ether	
Benzene	
Methyl alcohol	
Ethyl alcohol	
Butyl alcohol	
Transformer oil	

MOLDING WITH ELECTRIC HEAT

(*Continued from page 41*) be if steam heat were used.

The economy of this electric heat installation and the complete satisfaction of the user are best expressed in the words of the factory manager of the company: "Square D has checked its cost of heating on a typical mold used in the 100-ton press and finds that it costs only about 6.3 cents per hour to heat this mold when it is being operated 24 hours a day and that it costs 8.5 cents per hour to heat the mold when operated for an 8-hour day. This latter cost, of course, includes the power used in heating up the mold before the day's operation is begun, usually requiring an hour and a quarter to an hour and a half.

"Square D Company feels that one very decided advantage in the use of electric heat is the fact that there

are no steam leaks, and accordingly the humidity in the molding room is not increased by this factor. Also, the question of plumbing repairs to flexible couplings does not bother, as there is nothing of this sort to maintain. Girls performing the cleaning and other operations after the pieces are pressed, do this work right in the molding room which is evidence of the fact that the presence of the presses does not cause discomfort due to humidity and heat.

"In conclusion, due to the economy of operation, the very accurate control of temperature, the absolute cleanliness and freedom from humidity, Square D officials would not consider changing to any other method of heating."

In the past 7 years a large number of plastic molding presses are reported to have been converted to electric heat or originally built for electric heat based upon design of electric heating unit applications developed by the Wiegand Company.

With the use of electric heat it is possible to operate different presses automatically at different molding temperatures and it eliminates boiler and steam line maintenance. Electrically heated molds or platens make it possible to shorten molding cycles. Since each press has its self-contained heating equipment it is possible to operate presses independently, making short production runs economically it is claimed. The quick heating of electrically heated molds or platens from a cold start eliminates delays that occur where it is necessary to start up a cold boiler before it is ready to use.

ENGRAVING PLASTICS FOR IDENTIFICATION

(*Continued from page 20*) ducing maps from larger to smaller scale. The work is reproduced either one-half or one-quarter the size of the original copy used.

If no exact reproduction is required a penciled line on a paper sheet can be used, such as reproducing a signature on a fountain pen. The operator merely traces along the lines of this signature and even if he should fail to follow them exactly, there will be no apparent difference in the result. Master guides of transparent cellulose nitrate can be used. They may be cut with a line just deep enough to permit the tracing point to follow without slipping away.

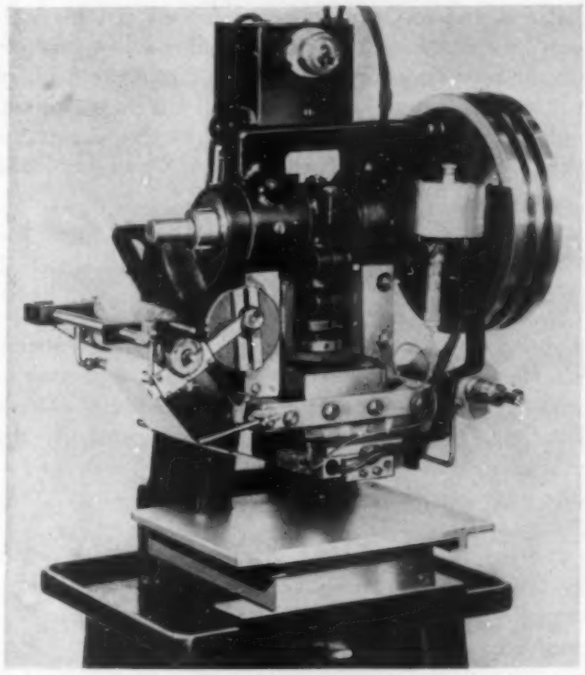
Wherever it is desired to reproduce printed characters brass type is set up in the holder very much like printer's type. The object to be engraved is placed in the holder beneath the cutter and the type (or signature) traced with the tracing point. This is done at about the same speed with which a signature could be written on a sheet of paper. The engraving is then filled in the desired color and the entire procedure takes from one to two minutes to accomplish.

The machine will engrave on flat, curved, oval or round objects and the engraving is claimed to be permanent since it is deeply cut and cannot wear off or be erased. This method of marking plastic materials is not expensive and no previous experience is required to operate the machine.

BRANDING YOUR PRODUCT

(*Continued from page 19*) or dies. A combination stamping and embossing die may be used on thermoplastic materials but is not practical for articles made of thermosetting materials. Dies are usually attached to the press by screws or by gluing to the die plate if they are 1/4 in. dies. But dies that are type high or actual type may be inserted in a special chase and locked in.

Stamping on cast resins, phenolics, ureas, pyroxylins and acetates is frequently done, and the new transparent plastics, it is claimed, will open up a large field for plastic signs. Glass signs which are commonly used for advertising purposes require the lettering either to be laid on with gold leaf or painted. This takes one man about two hours to produce one sign. Transparent resins, however, can be stamped with roll leaf—any metallic or pigment color—and the same sign reproduced at a rate of thirty per minute.



Plain power stamping machine. (Photo, courtesy Griffin, Campbell, Hayes, Walsh, Inc.)

Poker dice are being printed with different colored face figures. This eliminates the cutting out and wiping in process which on molded items is an expensive procedure. It costs one third as much to do a stamping job as a wipe job, since the latter must be finished, polished, wiped off and cannot be shipped until it is dry. With the roll leaf process an item may be stamped, packed and shipped with no time lost in waiting for the lettering to dry.

A tooth brush manufacturer whose product had a molded acetate handle and a small hole at the top for hanging, wanted his trade name printed across the handle. He was having it done by hand, and was putting out fifty brushes a minute which had to dry and had to have the hole drilled in. A special press was designed

for him which enabled the handles to be fed from a hopper, and they are now fed, stamped and ejected at a rate of 110 a minute. The machine also drilled the holes and countersinks at the same operation.

It is inevitable that the development of roll leaf stamping will open up fields for the use of plastic materials where they have never been used before. Molders may find that owning a stamping press which they operate for their individual use will procure business from concerns who have steered clear of plastics because of the costs of cutting lettering into the molds.

Many companies would like to package items in boxes available from stock molds. To identify their packages with their trade name stamped in is now a comparatively simple and inexpensive procedure. Premium users can have cosmetic items such as cream jars, powder boxes, rouge boxes, lipstick containers, and other reuse packages and novelty items stamped with the company trade name as well as any selling copy they desire.

It is logical to assume that with such inherent possibilities, the roll leaf stamping process will be welcomed by molders and fabricators and should contribute toward extending the use of plastics in many fields of industrial endeavor. Presses and roll leaf for the stamping of plastic parts are manufactured by several concerns including Griffin, Campbell, Hayes, Walsh Inc., and Peerless Roll Leaf Co. Inc.

A DESIGNER'S OPINION

(*Continued from page 25*) themselves to all manner of forms that were impossible in other types of manufacturing and make possible unique effects because of their flexibility. Another important feature of plastics is the high polish obtainable which will not easily mar or scratch, whereas with certain types of castings you have to contend with rough surfaces which must first be cleaned and finished."

One has to glance only hurriedly through any one of the Sears Roebuck stores to see how generally plastics are succeeding older materials wherever their application is practical. Hardware, stove handles, knobs on all sorts of kitchenware, faucet handles, door knobs and other replacement items all bear evidence of the constant thought given these new materials when redesign occurs. The continuous exposure of plastics to public examination on the miles of counters in these important retail stores will promote their understanding and acceptance in no uncertain way. The immediate acceptance of the Election Model Radio can be traced in a measure to its newness and beauty, but of equal importance perhaps is its price which was made possible through a molded case.

Sears was the first to present an all-molded electric fan, called the Airflow Safefan, which you may remember was pictured in MODERN PLASTICS in August 1935. Their new electric stove has a chromium panel in the center just below the lighting fixture in which plastics are used for control knobs and clock. In redesigning their cream separator, a plastic handle was incorporated for its tactile qualities and decorative appearance.

A plastic knob is used on the lid of their new Kenmore washer, and their electric ironer uses red plastic for the handle on the lid, heat control knobs, shoe control handle and switch buttons. Their Heatmaster hand iron has a well designed plastic handle, and their redesigned Thermos jug has a blue plastic top with bright red handles. Pressure cookers have phenolic handles and knobs and there are cutlery and utensil handles galore.

In the jewelry department I noticed they displayed diamond rings in green and black plastic jewelry boxes. The sales girl said people were much attracted to these containers. The same department displayed pen and pencil sets in black plastic boxes with ivory covers which could be reused for cigarets.

Mr. Morgan is particularly interested in the possibilities of metal inlays for decorative purposes and believes the effect is refined and unique. He is of the opinion that decoration of that sort would make plastics attractive for jewelry and silverware boxes.

These thermos jugs have dark blue molded tops with bright red handles to contrast the light blue lacquer of the jugs themselves

He also believes there is a big educational job ahead for the manufacturers of plastic materials and that the progress of the materials into everyday things depends upon the ingenuity of the molder and material manufacturer to prove to the industrial manufacturer and to the consumer that their product is adaptable to their use.

"Not sufficient thought has been given by the molder or mold maker," he continued, "for the proper development of surface contour. I experienced the same difficulty in the automobile business when designing bodies. The mechanics and engineers were not acquainted with methods to produce developed surfaces. A fender was simply a piece of strip stock stamped out with a simple die which gave curvature over the wheel. The diemakers were forced by the designers to do a more conscientious job in die making. So, the molder too, will have to be-

come familiar with the requirements of proper surface development so that he can conscientiously interpret the ideas of the designer.

"In other words there must be a reasonable understanding of third dimension before intelligent designs can be translated into plastic materials. That's why clay modeling was originally started by the automobile designer—to enable the die maker and the full sized draftsman to render accurately the curved surfaces in today's car. The molders haven't yet been able to appreciate that little difference between engineered surfaces and designed surfaces. When they do, many new things will be molded in their plants."

PHENOLIC LAMINATED GEARS

(*Continued from page 17*) gradual reduction in cost of the phenolic resin and the use of macerated treated fabric used to form the center of the blanks, this type became firmly established as the accepted form of timing gear even to the present time with perhaps slight modifications. The form of rim generally changed from the quarter segments to a multiplicity of segments obtained by punching diamond shaped pieces from a strip of treated fabric folding the strip and wrapping on edge. It will be noted that this, in reality, is a multiplicity of segments of about one inch in length. This produces a uniform distribution of threads in the fabric which consequently results in uniform wear of all the teeth in the gear. The waste in producing the rim is also greatly reduced by this method being less than 10 per cent compared to about 30 per cent for the quarter segment rim formation. Figure 8 shows the built up rim and notched strip used in this multiple segment rim as well as an all-molded type gear with metal bushing.

The foregoing description of individually molded blanks alludes to automotive timing gear principally, although where quantities warrant such molded blanks can and, to a more limited extent, are applied to industrial gear applications. The worm gear shown in Fig. 5 is a molded form gear blank. The greater proportion of industrial gears, however, are machined from blanks cut from stock plate or board. This is true because the number of gears of any given size is generally comparatively few and it is more practical to saw the required diameter blank from a plate of the desired thickness.

The thickness of the gear plate stock was originally two inches, then three inches which was standard maximum thickness for several years. Gears of a wider face width than the stock material were built up from two or more thicknesses riveted together. However, the continued demand for gears of wider face than the three inch maximum stock thickness led to the next increase to five inch thickness. Before putting the five inch thickness on the market complete tests were made by taking test specimens from various locations in the plate to assure uniformity of strength throughout the whole body of the plate.

The final step in thickness of stock gear plate was ten inches as standard although actually twelve inches was

reached in a few special cases. The same check tests as described for the five inch thick plates were made on the ten inch before it was made a commercial standard thickness. It is interesting to note that such a ten-inch-thick plate thirty-six inches square weighs almost one third of a ton and in value is about equal to the price of a complete car in the lower price field. The time required to mold such a plate including both curving and cooling is the greater part of a day and night.

Structural details and capacity

In concluding this résumé of the first quarter century of phenolic laminated gears, a word about general design features and load rating capacities may be in order. In the automotive field there was originally a mere substitution of the phenolic laminated gear for one of the gears in the timing train, generally the cam gear in a three-gear train or the idler gear in a four-gear train. This resulted in very marked improvement in the quietness of operation and a reasonably long life.

Along with other developments and improvements in the engine the timing drive was also improved and simplified, removing from the timing drive all but the necessarily positive drive elements, namely, the valve and ignition distributing mechanism. By so doing the modern gear timing drives are the ultimate in quietness and in most cases average the life of the car. In this timing gear drive phenolic laminated stands alone as the material able to satisfactorily meet the conditions of the application.

In the industrial field, as referred to previously, it is applied to almost innumerable types of apparatus and machinery. In most of the earlier as well as many present-day applications, it is substituted for existing gears or pinions either of metal or some other non-metallic material. In many cases, especially where it has been substituted for a metal gear or pinion, it may be carrying a load which works the material well up in stress to its ultimate limit. Under conditions of uniform load it may give quite reasonable life under extreme loads. Actual operating tests at fairly high pitch line velocities showed that loads could be applied which stressed the teeth almost to the breaking limit and yet give reasonable life showing comparatively slow wear under the high tooth pressures.

The low modulus of elasticity results in lowering the increment loads due to tooth inaccuracies and spacing at the higher velocities thus permitting greater actual tooth loading at these higher speeds or a resultant greater actual power transmitting capacity. Based on tests and service experience the speed factor in the Lewis formula for calculating strength of gears was changed from the $\frac{600}{600 + PLV}$ generally accepted for metal gears to $\left(\frac{150}{200 + PLV} + .25\right)$ for non-metallic gears of this type.

Figure 6 shows a curve of the two speed factors based on an initial allowable fiber stress of 6000 lbs. per square inch. The coordinates of the curve are pitch line veloci-

ties in feet per minute and resulting fiber stresses for the given speed factors. It will be observed that after approximately 1000 feet per minute pitch line speed the modified speed factor curve is above the other and shows a rather decided advantage in rating capacity with increasing speed. This modified factor in the Lewis formula was accepted generally by the gearing industry.

More recent practices accepted by the gear industry are such factors as standard preferred pitch table which gives recommended diametrical pitches for various ratings of horse power and speed—Bore tolerances for given size shafts—Relation of gear or pinion diameter to shaft diameter to regulate the amount of material between keyway and root of teeth—allowable keyway stresses—and recommendations for mating gears as to material and condition.

The gearing industry in general recognizes the importance of phenolic laminated as an important addition to the class of material from which it can draw to fulfill the particular needs to which it is so well adapted and the beginning of this material was the progressive initiative that saw a quarter century ago the possibilities of mechanical applications such as gearing of what was then primarily an electrical insulating material.

THE MUNSELL SYSTEM OF COLOR SPECIFICATION

(*Continued from page 42*) imagine a series of values running from black through the grays and up to the white (see Figure 1). The eye can readily distinguish and memorize ten different steps of value, hence the numerical notation of value runs from 0 (black) to 10 (white). Any pure gray is known as neutral and is indicated by the initial N. At the level of each step of value is a plane including all colors of the same value as the neutral. Intermediate values between the ten principal steps may be noted decimally.

For the notation of chroma, imagine lines drawn radially on each plane of constant value from the neutral center to the strongest chroma obtainable in each particular hue. The equal steps of chroma are numbered outward on these radial lines starting from zero at the center. Intermediate chromas may be noted decimally.

For the notation of hue, imagine the different hues running from red in a clockwise direction through yellow, green, blue and purple back to red again. The hue circuit (see Figure 2) is divided into five equidistant principal hues (red, yellow, green, blue and purple), and five intermediate hues (yellow red, green yellow, blue green, purple blue and red purple). In this arrangement of ten hues around the circumference of circular value planes, each is placed diametrically opposite its complementary color (red is opposite blue green, etc.), so that by mixing the two hues on the opposite ends of any diameter, a neutral gray corresponding in value to that of the vertical axis at the point of intersection is produced. A numerical notation is provided by considering that each principal and intermediate hue is the center of a group of 10 hues which are numbered in a clockwise direction from 1 to 10. Each group of 10

hues derives its name from that of the principal or intermediate hue contained therein. In describing colors the hue number is placed before the hue initial, as 2R, 7Y, 9YR, etc.

For a complete color notation according to this system hue, value and chroma are written HV/C. Thus a typical "pink" would have the notation 5R8/2, indicating that it is 5R in hue, 8 in value, and 2 in chroma. A typical "slate gray" would have the notation N2/, indicating that it has no hue or chroma but is 2 in value.

In establishing standards of value for the three dimensions of color, a vast amount of research has been necessary. This has finally been put into usable form in the Munsell Book of Colors. The fundamental physical basis of color specification is the spectral reflection or transmission curve. For example, any of the colors illustrated in the Munsell Color System can be measured in a spectrophotometer and the reflection factors determined for any desired number of wave lengths throughout the visible spectrum. The plotting of reflection factors against wave lengths results in the spectral reflection curve.

The subject of Spectrophotometry has been quite thoroughly covered elsewhere and need not be discussed in detail in this paper. Suffice it to say that on the basis of the I.C.I. (International Commission on Illumination), Illuminant C and the standard I.C.I. observer, determined at the meeting of the International Commission on Illumination in 1931, it is possible to convert the spectrophotometric data into the tri-stimulus values (X, Y and Z), then into the trichromatic coefficients and finally into the three properties of dominant wave length, brightness and excitation purity. These three properties correspond to the qualities of hue, value and chroma which are illustrated in the Munsell Color System: dominant wave length corresponding to hue, brightness to value and excitation purity to chroma.

Recently a trichromatic analysis has been made of all the colors illustrated in the color scales on the charts in the Munsell Book of Color. Each color sample, backed by a standard white material, was compared in an automatic recording photoelectric spectrophotometer against a freshly smoked surface of magnesium oxide deposited on magnesium carbonate and the spectral reflection curve was thus obtained. The spectrophotometric data were converted into tri-stimulus values, using thirty selected wave lengths for the integration of each function, and then into terms of dominant wave length, brightness and excitation purity. The results have been submitted for publication in the report of the Colorimetry Committee of the Optical Society of America which is now in preparation.

Thus, the foundation has been laid for the correlation of the physical and the psychological methods of color specification. It will soon be a relatively simple matter to convert the spectral reflection or transmission curves, which constitute the physical specification of color, into the psychological color attributes of hue, value and chroma. The average person has difficulty in visualizing the differences between colors by a comparison of

their spectral reflection curves, but for anyone familiar with the charts of the Munsell Color System and its terms of relative hues, values and chromas, this difficulty vanishes. The number of colors in the charts is limited but this system of color notation is all-inclusive. For example, the charts illustrate only 20 equally spaced hues, but the system provides for increasing the number of hues up to 100 or even more, if the eye can distinguish smaller differences in hue. (See the Munsell Color Company 100 hue Chart of 5 value and 5 chroma.) The charts illustrate 9 steps of value between black and white but the system of notation, by the use of decimals, provides for as many steps of value as the eye can distinguish. (See the Munsell 50 step value scale.) In the same manner, the intervals of chroma which are illustrated on the charts may be subdivided into as many steps as the eye can differentiate, and noted decimally. (See the Munsell 27 step chroma scale.)

Experience has shown that the average observer, after a reasonably careful study of the color scales, can visualize a large number of intermediate hues, values and chromas and estimate their notations with an accuracy sufficient for many commercial purposes. Even colors of substantially stronger chromas than those illustrated on the charts can be visualized with reasonable accuracy as being so many steps beyond the strongest chroma shown on the appropriate value level.

Colors in commercial color printing are regularly specified by the designer to the printer in Munsell notations, in many instances being transmitted by telephone or telegraph. This method results in an obvious saving in time, particularly when the designer is located at such a distance from the printer that one or more days would be required for the transmission of color samples from one to the other. It has also been often found that a more accurate reproduction of the desired color is made on the basis of the notation than by the actual matching of a color sample which may be quite small or may have become soiled by handling.

Just this summer the Munsell System was being used to identify the new colors which had their first showing in the salons of the Paris dressmakers. These color notations are transmitted by cable to a large department store in this country which is arranging to place reproductions of these colors on sale within forty-eight hours of the original showing in Paris. Thus it is possible to reduce the time for American duplication of Paris fashions to hours rather than days.

In addition to the specific examples given above, this system has been used by printing ink manufacturers to specify the colors of their inks; by textile and paper manufacturers to grade their standard colors; by department stores as a basis of coding colors for their various departments; and by artists, designers and educators as an aid in the creation of harmonious color combinations and in teaching the fundamentals of color. Because of the fact that such pains were taken to create a balanced color system in which all of the colors bear a definite relationship to each other, it is possible to use its charts to select suitable colors for harmonious effects in varia

tions of value and chroma in a single hue, or in two color or three color combinations by the proper balance of values and chromas in complementary hues or adjacent hues.

The Munsell system may be adapted to any degree of accuracy required from the simple naming of a color to an exact numerical specification. The U. S. Pharmacopoeia is at present sponsoring a study at the National Bureau of Standards in Washington which has for its object the standardization of the color nomenclature in the next edition of the Pharmacopoeia. It is planned to use the adjectives light, medium and dark to designate value and the adjectives weak, moderate and strong to designate chroma in combination with a noun designating hue. For example, the color of belladonna leaves, which is now described as serpentine green, would be described in the new system as a medium weak yellow, indicating that it is medium in value, weak in chroma and predominantly yellow in hue.

Where greater accuracy in color specification is desirable, it can be obtained by the method of matching the unknown color by blending measured areas of the standard Munsell color discs. This method of color analysis has been successfully used by the United States Department of Agriculture for measuring the color of raw cotton and establishing definite color grades which are now in general use for rating the value of this basic textile material. In a similar manner, it has been found possible to establish color grades for hay and to set up a standard specification for the color of fresh beef and of pure tomato catsup.

The Munsell Color System is as fundamental a specification for the psychological sensation of color as the spectral reflection curve is for the physical excitations which produce color.

SYNTHETIC PLASTICS FROM MIXED PHENOLS

(*Continued from page 39*) They are all of the same general nature, consequently the following generalizations seem justified: An increase of 25° F. decreases the time of cure four to six minutes, in the common molding range—300°–400° F. Below 300° F. the time of cure is inordinately long while above 400° F. the decrease in time of cure with temperature is slight. In addition, at the higher temperatures the satisfactory molding range is much shorter and the molded objects have a tendency to develop surface blisters.

Conclusions

1. The addition of even small percentages of any of the three cresols to phenol greatly increases the time of cure required for the production of a molded product.

2. The cresols may be ranked in the following order, on the basis of their applicability for synthetic plastic production: m-cresol, p-cresol, o-cresol.

3. Resins containing more than 70 per cent cresol in the mixed phenols will not harden, on cooling.

4. The optimum time of cure changes in an irregular manner with the cresol content. (*Continued next page*)

5. An increase of 25° F. in the molding temperature decreases the time of cure for a phenol-formaldehyde type of plastic from four to six minutes. Molding pressures have little or no effect on the time of cure.

TABLE II—DATA ON RESINS PREPARED FROM BINARY MIXTURES OF PHENOL AND CRESOLS AND MOLDED AT 325° F.

Resin Number	Molding Time Minutes	Reaction to Boiling Water Test
1	4	undercured
	5	slightly undercured
	6	cured
	7	cured
	8	cured
	9	slightly burned at edges
2	6	not cured—stuck in mold
	8	undercured
	9	slightly undercured
	10	cured
	11	cured
	12	cured
3	10	not cured—stuck in mold
	15	" " " " "
	18	undercured
	20	cured
	21	cured
4	16	slightly undercured
	17	cured
	18	cured
	19	cured
	20	slightly burned
5	17	not cured—stuck in mold
	19	slightly undercured
	20	cured
	21	cured
	23	slightly burned
6	14	slightly undercured
	15	cured but must be cooled in mold
	16	" " " " " " "
	17	" " " " " " "
	20	burned
7	13	undercured
	17	slightly undercured
	19	cured
	22	slightly burned
8	18	undercured
	19	slightly undercured, rough appearance
	20	cured, rough appearance
	22	slightly burned, rough appearance
12	10	badly undercured
	15	badly undercured
	19	slightly undercured
	20	cured
	22	cured
	24	slightly burned
13	15	slightly undercured
	16	cured
	18	cured
	20	slightly burned
14	10	slightly undercured
	11	cured
	12	cured
	13	cured
	16	burned
15	9	slightly undercured
	10	cured
	11	cured
	13	slightly burned
16	8	slightly undercured
	9	cured

	10	cured
	12	slightly burned
17	16	undercured
	19	undercured
	21	slightly undercured
	22	cured
	25	slightly burned
18	15	undercured
	18	cured
	19	slightly overcured
	20	burned slightly
22	14	slightly undercured
	15	cured
	16	cured
	18	cured
	20	slightly burned
23	11	slightly undercured
	12	cured
	13	cured
	14	cured
	15	cured
	17	slightly burned
24	15	badly undercured
	20	undercured
	22	slightly undercured
	24	cured
	27	cured
	29	slightly burned
25	10	slightly undercured
	20	cured
	22	cured
	25	slightly burned
26	19	slightly undercured
	20	cured
	25	cured
	27	slightly burned
27	16	undercured
	18	slightly undercured
	19	cured
	23	cured
	26	slightly burned
28	17	slightly undercured
	18	cured
	21	cured
	22	slightly burned

TABLE III—EFFECT OF TEMPERATURE ON TIME OF CURE OF VARIOUS RESINS DESCRIBED IN TABLE I.

Pressures—5000 lbs. per sq. in.

Resin Number	Temperature ° F.	Time Min.
1	300	12
	325	6
	350	3
	375	2½
4	325	17
	350	12
	375	8
	400	4
	425	2
14	325	11
	350	8
	375	3
	400	2
24	325	17
	350	13
	375	9
	400	5
	425	2
	475	1

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